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VETERINARY MEDICINE

JUNE 1939

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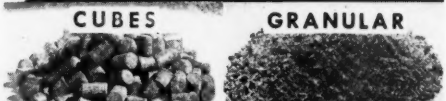

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In one of the cantons of Switzerland, turning an animal out to grass within a six-week period following abortion has been prohibited for more than 200 years.

* * * *

A recent survey disclosed that of the 874 municipalities in the nation that have adopted the uniform milk ordinance recommended by the U. S. Public Health Service, only 148 (17%) are enforcing it adequately.

* * * *

Research work carried out at Swansea Technical College, Wales, has resulted in the development of a bread made from oat flour. The oat bread, similar in appearance to ordinary brown bread, contains 28% of carbohydrates, compared with 25% in wheat bread; 7.2% of fat, compared with 1.7%; 16.1% of protein, compared with 11.1%; and three times as much calcium.

* * * *

A short cut in refining beef has been developed recently by the Mellon Institute. Formerly, freshly killed beef carcasses had to be held at 33° to 38° F. for four to eight weeks to produce the highest quality steaks. By the new process an equivalent ripening is attained in two to three days by holding the meat at 60° F. in airconditioned rooms and preventing bacterial and mold growth by ultraviolet light.

The introduction of ether anesthesia by Crawford M. Long (1842) and of antisepsis by Lord Lister (1868) are regarded as the two most valuable contributions to medicine during the 19th century.

* * * *

The Royal Veterinary College of Denmark was established in Copenhagen in 1773 as a private school. It became a state school in 1856. At the present time it is housed in buildings costing approximately 2,000,000 kronen. About 40 students are graduated each year. The course is 6½ years. About 60% of those taking the course fail to graduate.

* * * *

An average of 57 quarts of milk a day for a period of 365 days is the new world's record for milk production set by Cherry, an eight-year-old, 1500-pound, English shorthorn cow owned by Red House farm, Amesbury, Wiltshire, England. Producing 41,644.5 pounds of milk in this period, Cherry is the first cow on record to produce more than 40,000 pounds in a year. Cherry's highest daily yield was 143¾ pounds; her highest weekly yield, 961¼ pounds. Her record is the more remarkable in that she is not strictly a dairy cow, the shorthorn being a dual-purpose animal used for both beef and milk production.

Cost of Veterinary Education

A few states, including several of the less opulent, are carrying the burden of veterinary education for the entire country. Ten states not only are educating veterinarians for the other 38, but also for the Federal government which is the largest single employer of veterinarians in the country. This situation obviously is not a fair one. Equally obvious is the fact that under our form of government it is going to be difficult to obtain a better spread of this support. It is conceivable that a plan might be evolved whereby those states which do not support schools would assist in the support of the schools of other states on the basis of a subsidy for each student sent and accepted by them. Such a plan has no precedent, so far as I know, and appears to me to be wholly impracticable. A somewhat better spread could be obtained if two or three of the more prosperous states whose live stock interests are large could be interested in establishing schools and an equal number of the less prosperous, which now are supporting inadequate ones, could be persuaded to abandon this educational field. While this would improve the situation by placing the burden where it could be better carried and would undoubtedly also strengthen our educational system, it still would leave the burden on a small proportion of the country's population.—*W. A. Hagan,* 16th annual veterinary conference, University of Illinois.

Veterinary Science a Branch of Medical Science

So far as the content of their curricula is concerned, the veterinary schools are much more closely related to schools of medicine than to schools of agriculture. It is the interest of the agriculturalists, however, which must be depended upon to help obtain adequate support from governmental units, for, except for pet owners in the cities, no other group has any particular interest in the profession. For purely selfish reasons, if for no other, the veterinary profession should remember this. It should coöperate in every way with agriculturists, and they should be made to see that the profession is not a group of men who are preying on the misfortunes of the live stock owners, but are rather an indispensable group whose welfare depends no less than theirs on improving animal health and in saving useful animal lives. The attitude of the veterinary profession in this matter could be improved. There are still too many members who are thinking of profit before service, not appreciating the wisdom of the motto of one of our service clubs that "He profits most who serves best." The veterinary educators must assume the responsibility of doing a better job of instilling the truth of this statement in the veterinarians of tomorrow.—*W. A. Hagan,* 16th annual veterinary conference, Univ. of Illinois.

State and Private Veterinary Medicine Incompatible

In many of the states, including some which are now supporting veterinary schools, the animal populations are so small or the economic condition of animal owners is so poor that conditions for private practice are not very good. In some of the states where conditions for practice otherwise would be favorable, the encroachment of county agricultural agents into the field of veterinary medicine are so great as to make these states unattractive to young graduates who are looking for a reasonable recompense for their efforts. Where laymen, particularly those who are supported on governmental salaries, are permitted to practice any phase of veterinary medicine, the prospect for a veterinarian in private practice, without subsidy of any sort, is not attractive. A system of state medicine can be operated with reasonable success in any area, I have no doubt, and private practice likewise can give satisfactory results, but when mixing of the two is attempted, dissatisfaction can be the only result. It must be a matter of the whole hog or none.—*W. A. Hagan,* 16th annual veterinary conference, University of Illinois.

New Order Aids Live-Stock Disease Control

A new regulation of the U. S. Department of Agriculture, designated as Amendment 14 to Bureau of Animal Industry Order 276, requires a special permit for importing cultures or collections of organisms or viruses and for transporting them from state to state. It requires a special permit also for the similar handling of experimental animals treated or inoculated with such materials.

Administration of the new regulation will be supervised by D. I. Skidmore, Chief of the Division of Virus-Serum Control of the Bureau of Animal Industry. Doctor Skidmore points out that the new safeguard, while giving additional protection to live-stock health, will not interfere with the normal importation or interstate movement of veterinary biological products as customarily handled under regular permits.

Consumption of Uninspected Meat Increasing

The National Provisioner lists each week an average of about 10 new cold storage locker plants with a total capacity of about 3,500 lockers. Assuming that each locker will handle an average of 1000 pounds of meat annually, there is a weekly addition of 3½ million pounds to the amount of meat (practically all uninspected) that passes through these channels annually, or a yearly increase of 182 million pounds of meats. It would not be correct to say that all of this meat is being removed from the inspected to the uninspected supply. Some of it was uninspected before the consumers of it were supplied with cold storage lockers —used while fresh or as home cured products; but a large part of the meat the farmer and town or city dweller now get from the locker they formerly obtained from their favorite meat market, and 2/3 of it was federally inspected. Viewed in any light, the growth of cold storage locker plants represents an enormous increase in the consumption of uninspected meats.

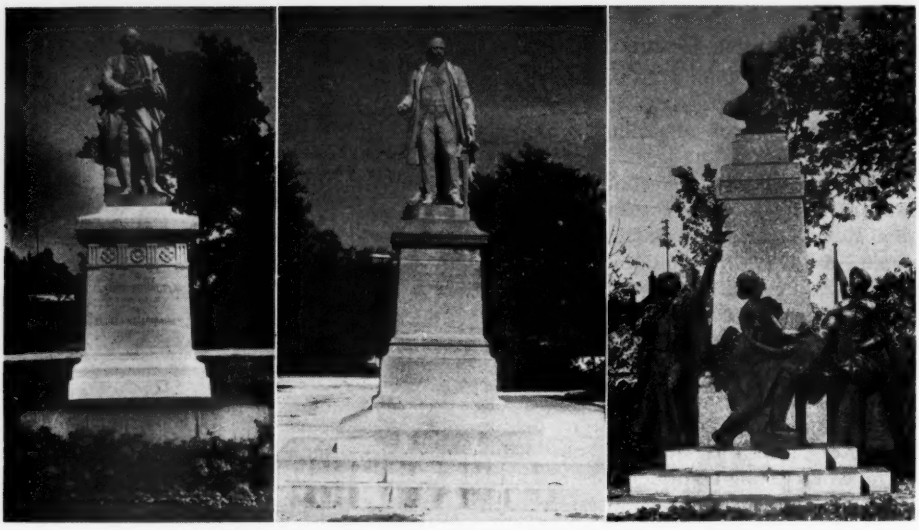
Cattle scab has been a recurring problem of stock men of the Middle West for many years.

Above all things, I require from a good abdominal incision that it provide adequate exposure.—"Gallenwege Chirurgie."

In the case of elective incisions anywhere throughout the body, strive to interfere as little as possible with nerve and vascular supply. The rate of wound healing and the incidence of postoperative hernia [in abdominal operations] are both determined to a large extent by the interference or non-interference with blood and nerve supply.—*John Burke,* M.D.

Nature impels man to invent and discover the ways and means for exercising a greater control over his environment in order that his life may be easier and more complete. The ant and the bee labor and save and have a highly organized society, but they do not progress appreciably. It is man's ability to improve his workmanship, his ability to discover and invent, that makes it possible for him to progress.—*Illinois Society for the Protection of Medical Research.*

Townson and Gorden reported the occurrence of acute arsenical poisoning in swine and poultry in *Veterinary Record,* Vol. 50. Seven of nine pigs manifested an intense gastroenteritis and died. Of 150 hens, 120 died. The swine and hens were fed the same meal. A short time after feeding, the hens became very ill. They evidenced intense thirst, inappetence and a tendency to paralysis. The lesions found consisted of congestion of the skeletal muscles, catarrhal inflammation of the mucosa of the proventriculus with sloughing, and a serofibrinous exudate beneath the lining of the gizzard. By chemical analysis the crop content was found to contain 0.1gr of arsenic per ounce. The original source of the arsenic was undetermined.—*Hughes, Vet. Bull.,* 9:1.



Bourgelat Bouley Nocard

STATUES ON THE GROUNDS OF L'ECOLE NATIONALE VETERINAIRE D'ALFORT

L'Ecole Nationale Vétérinaire d'Alfort

Enroute to the XIII International Veterinary Congress in Switzerland, August, 1938, a party of American veterinarians visited the veterinary college at Alfort, a suburb of Paris. At another time it may be convenient to mention some of the interesting things observed in the school and in the national research institution adjoining. The first impressions of the school are obtained from the attractive campus and particularly from various monuments erected to commemorate the services of distinguished veterinarians, to the institution and to France. All members of the American party commented upon the desirability of this practice to instill into veterinary students a familiarity with the traditions of the profession and a respect for them. They regretted that among American veterinary colleges a single statue at Iowa and a few oil paintings at New York State and Pennsylvania comprise the total acknowledgment to the founders and builders of the veterinary service of this country. Briefly, the achievements of those for whom were erected the monuments illustrated herewith may be listed as follows:

■ Born to luxury and educated for the law, Claude Bourgelat gained international renown as a horseman. He was born in 1712; following his legal education he succeeded his father, a prominent attorney, in the practice of law. In 1740 was appointed *écuyer* (horse master) of the Academy of Equitation at Lyon. In 1751 he published a three-volume work, "Elements of Hippiatry and New Knowledge of Equine Medicine," in which he advocated the founding of a veterinary educational system. Eleven years later he founded the Royal Veterinary School of Lyon, the first public veterinary college of modern times, and in 1765 the Veterinary School at Alfort. (Both of these institutions are still in existence.) He died in 1779.

A fact not generally mentioned in the life of the founder of the veterinary educational system of France is that he had conducted a private veterinary school which the government had pointed to as *"son école distinguée de maréchalerie"* long before he established the official one in 1762. He was celebrated for having furnished excellent remounts for several cavalry regiments of the King, and for having eradicated glanders from other regiments of mounted troops. Because of his well earned reputation in equine husbandry his government sent him to Lorraine to install a breeding establishment for the King of Poland.

That Bourgelat was a man of letters as well as a practical horseman is indicated both by his books on veterinary medicine and

by his appointment in 1761 as librarian for the cultured city of Lyon. It is, however, as the founder of the veterinary educational system in France that the name of Bourgelat is indelibly inscribed in veterinary history.

■ The monument to the memory of Henri Bouley was erected by a fund subscribed to by veterinarians from all over the world. The contributions from American veterinarians were said by Prof. Liautard to constitute an amount in keeping with the importance of the profession in this country. The statue was unveiled during the V International Veterinary Congress held in Paris, September, 1889. The ceremonies were attended by practically everyone present at the congress, by many high officials of the French government, by delegates from every part of France, and by representatives of scientific institutions from foreign countries. Speeches were made by the Minister of Agriculture and by MM. Chauveau, Leblanc, Tisseraud, Nocard and Degive.

Henri Bouley was born in Paris in 1814 and died after a protracted illness in November, 1885. His whole career in the veterinary profession was one of distinction and eminence. He was successively professor at the Alfort veterinary school (20 years), inspector general of the veterinary schools of France, member of the Academy of Medicine, commander of the Legion of Honor, professor of comparative pathology of the Museum of Natural History, and finally president of the highest court of science, l'Académie des Sciences of Paris—the highest honor that could be conferred upon a scientific man by his fellow scientists. His death was mourned in France as a national disaster.

Bouley was the first figure prominent in science to support the discoveries and theses of Pasteur, and he remained one of the most steadfast. It has been said that Pasteur's work would have required a century for complete recognition but for the help of Bouley. He was the author of a number of books, among them "The Horse's Foot," "Glanders and Farcy," "Rabies," "The Dictionary of Medical Sciences," "Progress of Medicine by Experimentation"; and of a large number of articles published in veterinary and other scientific magazines. His work on "Rabies" is a classic, still authoritative in its field and still used.

■ The Missouri Valley Veterinary Association, the Michigan, Massachusetts and some other American state veterinary associations and many individuals contributed to the fund for the erection of the monument to Nocard, who at the time of his death, was held in world wide esteem.

Prof. E. Nocard was born in 1850; was graduated from the Alfort Veterinary School in 1873, and two months later was successful in a competitive examination for the head of the clinic in that institution. Five years later, as a result of another competitive examination, he was appointed head of the new department of surgical pathology also, with the rank of professor. His brilliant achievements soon attracted the notice of Pasteur, of whom he was ever afterward an ardent supporter, and he became associated with the Pasteur Institute. In 1883, he was selected by Pasteur, with Roux, Strauss and Thuillier, to go to Egypt and study cholera, a mission on which Thuillier died of cholera. On his return, he was made a chevalier of the Legion of Honor. In 1887 he was named Director of the Alfort school, taking the place of Goubeaux. At this time he gave up the chair of surgical pathology and clinic for that of contagious diseases. Four years later he was promoted to the rank of Officer of the Legion of Honor.

He was a member of many scientific societies and attended many scientific congresses, being selected at the Congress on Tuberculosis in London to reply to the statement of Koch that man was in no danger from bovine tuberculosis. Prof. Nocard was an honorary member of the American Veterinary Medical Association.

On a scientific mission to Algiers in 1903 he was stricken with diphtheria and very nearly died. This was followed by angina pectoralis, of which he died a month later. His funeral was attended by official delegates from many of the scientific institutions of Belgium, England, Germany, and elsewhere.

In his short life, Prof. Nocard accomplished an almost inconceivable amount of scientific research of the highest type. His contributions to veterinary literature were many and important. American veterinary publications often carried translations of two to half a dozen articles from his pen yearly.

* * * *

Some hope for the production of a highly potent chick-embryo rabies vaccine is derived from the fact that experimenters after attempting to grow rabies virus in chick embryos for years have succeeded recently in producing Negri bodies in chicks by injecting the virus into the eye or directly into the brain of 14-day embryos. The desire is to improve upon the antigenic properties of the tissue, rabies vaccine as the former tissue vaccine for encephalomyelitis was improved upon by the present chick vaccine for the prevention of that disease.

Fox and Mink Foods Study Will Benefit Fur Farmers

Fur farms in the United States, following a rapid development in the past 15 years, now produce about 300,000 silver-fox and 200,000 mink pelts annually, yet many fundamental questions on handling these wild animals have never been answered well enough to prevent heavy losses to fur farmers.

Nutrition, one of the fundamental problems, is now being studied in a coöperative five-year project recently inaugurated by the U. S. Biological Survey, and the Laboratory of Animal Nutrition at Cornell University.

* * * *

The United States has remained free of foot-and-mouth disease during a period when extensive outbreaks of the malady occurred in many European countries with which the United States has trade relations. Other serious foreign live stock maladies which have been kept out of the United States are rinderpest, contagious pleuropneumonia, and surra.—*J. R. Mohler.*

* * * *

Prevention is the best means of fighting contagious diseases, and the nation-wide program of tuberculosis eradication is the best example of controlling animal disease. Farmers everywhere have benefited from this campaign, and it has increased to a marked extent the appreciation of the need for well trained veterinarians in successful livestock production.—*Live Stock San. Com.*, Sioux City, Iowa.

* * * *

In swine investigations the studies of efficient rations for fall-farrowed pigs showed that good results in both rate and economy of gains were obtained by adding as much as 20% ground alfalfa hay to a well-balanced ration. In another experiment, night blindness of cattle fed cottonseed meal was prevented by the addition of a small quantity of green, leafy alfalfa hay to the ration.—*John R. Mohler.*

Clean herds, clean ground, clean stables, clean barns, clean pastures, properly drained, are the chief weapons to keep animals free from parasites.—*Robert Graham.*

* * * *

Studies of gain in weight of beef and milking shorthorn cattle showed that under similar feeding conditions the gain of the two types was approximately at the same rate. The gains of the beef shorthorns, however, were the result largely of added flesh, whereas those of the milking shorthorns were largely because of increased skeletal size.—*John R. Mohler.*

* * * *

During the fiscal year ended June 30, 1938, a total of 15,381 certificates of pure breeding were issued for the importation of breeding animals under the provisions of the Tariff Act of 1930. Cattle importations numbered 11,579 animals among which Holstein-Friesians, Herefords, and Ayrshires predominated. Of the 2,119 purebred sheep certified, the breeds represented in largest numbers were the Suffolk, Southdown, and Cotswold. Of the horse importations, the principal breeds were the Belgian, Thoroughbred, and Percheron. Other importations included 1,057 dogs and 12 cats of various breeds and 55 hogs, principally Yorkshires and Berkshires.—*John R. Mohler.*

* * * *

Improved means of studying sections of unpreserved bovine udder tissue affected with mastitis are described in Circular 514, just issued by the research workers of the U. S. Department of Agriculture. The stain used is a dilute aqueous solution of acid fuchsin prepared by dissolving one gram of dry dye in 2,000cc of cold water. The circular deals with the technique of staining and the interpretation of the results. Intensity of staining corresponds to the degree to which the disease has developed. The publication contains four pages and a colored plate and is entitled "Differential Staining of Sections of Unpreserved Bovine Udder Tissue Affected with Mastitis." Copies may be obtained on application to the Bureau at Washington.

Number of Stallions and Jacks Increases

During the three years, 1935-1937, data for the number of stallions licensed for public service in 22 states and jacks in 20 states having enrollment laws show increases as they did during the preceding period of 1932-1934. The total increase in stallions in 1935-1937 was 2,475, or 18.0%, while the total number of licensed jacks was increased by 96, or 7.1%, during the same period. The greatest increase in stallion enrollments in 1935-1937 was found in the draft class. This continues the upward trend begun in 1933 and again emphasizes the fact that horse breeders are primarily interested in the production of work stock rather than pleasure animals.—*S. R. Speelman,* U. S. Dept. of Agric.

The Racing Industry

There are over 100 race-tracks operating in the United States and Canada today. In 1910 there were 36. Last year the number of starters in races exceeded 1200. In 1913 there were 3,541. 1938 was the first year in the history of racing that the total purses awarded in the United States reached the sum of $15,000,000. The total revenue to states as a direct tax on racing was over $9,500,000. The total investment in the racing industry has been roughly calculated at upwards of $125,000,000.—*Leo Spitz,* in *Horse and Horseman.*

Horse Raising in Nevada

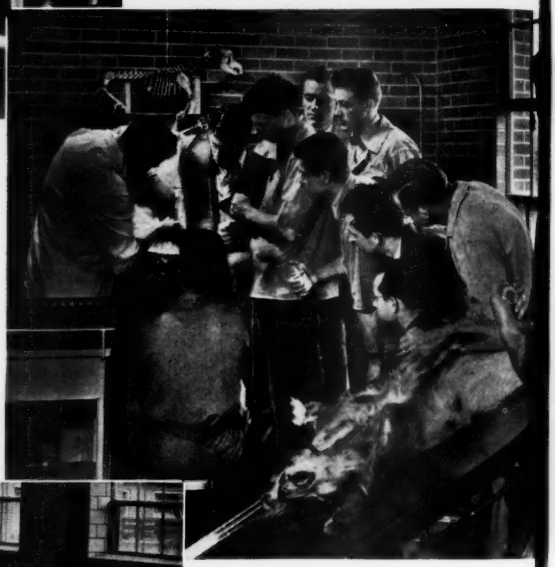
The interest in horse breeding doesn't seem to have been stimulated very greatly within the past two or three years. For a short time it seemed that farmers were interested in getting stallions into their sections and in producing horses for market. The equine encephalomyelitis situation as it has affected our state and surrounding states seems to have had an influence on the horse breeding program. Quite a number of farmers have purchased tractors and there seems to be at the present time an increase in the sale of tractors. Farmers who cannot afford to purchase tractors are breeding from grade stallions. There is an effort to popularize the standing of pure-bred stallions and to produce horses for farm work and for market, but that effort seems to be meeting with some opposition and indifference.—*W. H. Hendricks,* State Veterinarian of Utah.

To give farmers and other owners of work stock a better knowledge of infectious anemia (swamp fever), the Federal Bureau of Animal Industry recently issued Farmers' Bulletin No. 1819 describing the disease. The bulletin points out that infectious anemia cannot be cured by any treatment, and that there is no preventive vaccine of known value, but that the usefulness of an infected animal can be prolonged by treatment prescribed by a veterinarian, and that the disease can be controlled to some extent by protecting animals from insects, eliminating insanitary conditions, and avoiding overwork and underfeeding.

If the average rate of increase in the number of colts that have been raised each year since 1932 is continued for three more years, the rate of births will be high enough to offset the normal disappearance of animals and to maintain a total number of horses and mules of slightly less than 16 million head. The rate of increase in the birth rate of colts, however, tapered off somewhat in 1936. An increased rate of disappearance due to the higher proportion of horses and mules in the older age groups, together with a slightly lower rate of increase in colt production, might postpone until about 1942, the date at which the decline in numbers of horses and mules on farms will be stopped. On the other hand, more nearly normal feed supplies with lower prices for feed grains may accentuate the rate of increase in the number of colts so that the total numbers of horses and mules will begin to increase slightly after 1940. There is some indication also, that the performance of the heavier field work by tractors has increased somewhat the life expectancy of work animals.—*Bur. Agric. Economics,* U. S. Dept. of Agric.

POST-MORTEM LABORATORY, CHARLES HENRY STANGE MEMORIAL CLINIC

A senior class in post-mortem and clinical pathology is working in the laboratory. These subjects are taught in association with the daily clinics. During the past year, the two courses have handled 216 necropsies, 1180 clinical pathology examinations, and 800 fecal examinations. The instructors are E. A. Benbrook, R. A. Runnells, and M. W. Sloss.

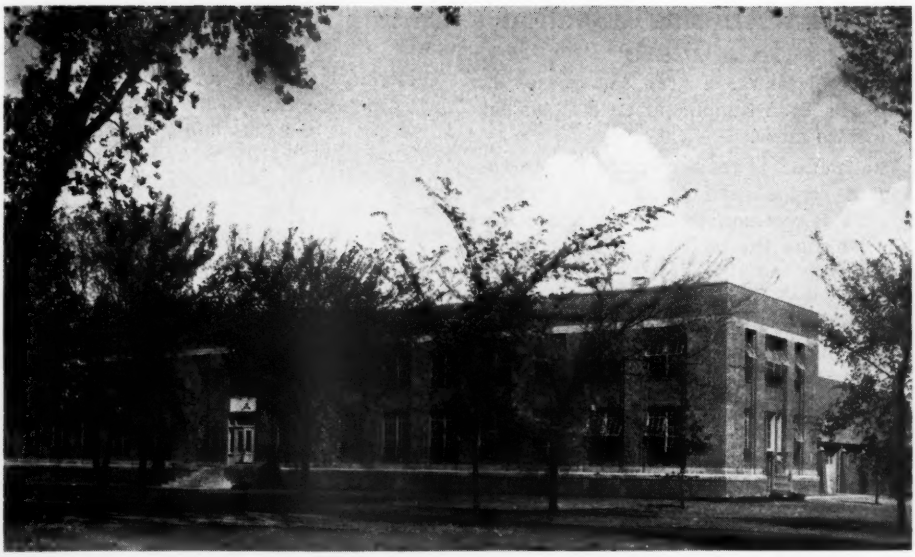


SMALL ANIMAL SURGERY CLINIC

This is one of the daily clinics in small animal surgery and medicine, held under the direction of C. H. Covault and D. A. Smith. The cases are handled by assigned seniors, with juniors as assistants. During the past year, 3616 dogs and 150 cats passed through the clinic.

LARGE ANIMAL SURGERY CLINIC

The students are seniors and juniors. Daily hospital clinics are held here, half of the senior and junior students being assigned to this and half to the small animal clinic. The instructors for this section are G. R. Fowler and M. J. Johnson. Large animals passing through the clinic during the past year included 1246 horses, 605 cattle, and 27 sheep.



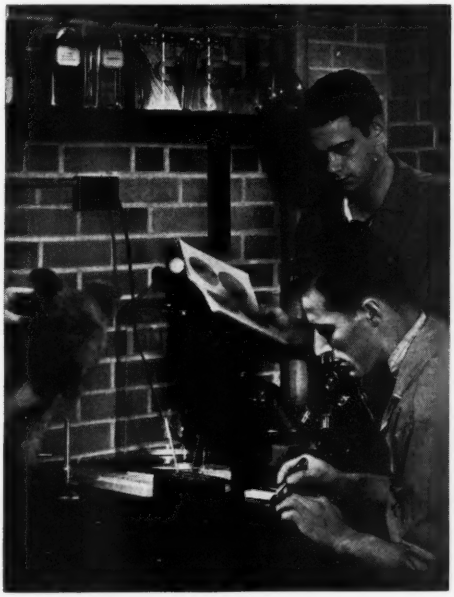
Charles Henry Stange Memorial Clinic, Iowa State College, Ames, Iowa

New Building Dedicated

The Charles Henry Stange Memorial Clinic, completed last year, is to be officially dedicated May 17. Erected at a cost of $180,000, it is the largest and most elaborately equipped building in the veterinary group at Iowa State College.

The veterinary course in Iowa State College was officially established in 1879. The original two-year veterinary course was extended to three years in 1887, and to four years in 1902. Milliken Stalker was dean of the division from its inception to 1900; John H. McNeil, from 1900 to 1908; Charles Henry Stange, from 1908 to 1936; and Charles Murray has been dean since 1936.

The school has graduated nearly one thousand men. Among the better-known of the early graduates are George C. Faville ('80); George H. Glover ('85), former dean of the Division of Veterinary Medicine, Colorado State College; the late W. B. Niles ('85), co-discoverer of the virus of hog cholera; the late S. Stewart ('85), former dean of the Kansas City Veterinary College; and the late C. A. Cary ('87), state veterinarian of Alabama for more than 40 years, and founder and former dean of the School of Veterinary Medicine, Alabama Polytechnic Institute. Of these, Glover, Stewart, and Cary held the office of president of the A. V. M. A. Other alumni who have been presidents of the A. V. M. A. are R. R. Dykstra ('05), C. H. Stange ('07), and H. D. Bergman ('10).



Clinical Diagnostic Laboratory.

Brucella Abortus Infection in a Mare

The subject was a grey cart mare, six years old, by a Suffolk punch stallion out of a Shire mare.

The mare, together with its three-months-old foal, was out at grass. On May 11, 1938, it was noticed that the mare was very lame on the off hind leg. There was considerable swelling and heat round the pastern, with distension of the flexor sheaths below the fetlocks, slight pressure on any part of the pastern causing pain.

There was no evidence of contusion, and careful examination of the foot revealed no injury.

Treatment with hot kaolin poultices was carried out, and the condition improved so that the mare was walking nearly sound at the end of the week.

Ten days later the mare became acutely lame on the off fore leg. The flexor muscle at the lower two-thirds of the forearm was swollen and painful to the touch. The carpal sheath was very much distended above and below the knee, and extremely sensitive to the touch.

The temperature was 102°F., and for the next two weeks it varied from 101°F. to 102°F. At the end of this period, lameness suddenly appeared in the near hind leg, the fetlock being the part affected, with painful distension of the sesamoid sheath.

At the suggestion of my partner, Mr. J. B. White, M.R.C.V.S., who had seen similar cases in cattle due to abortion infection, a blood sample was sent to the laboratory of the Ministry of Agriculture at Weybridge. The agglutination test showed that the serum was strongly positive to the equine strain of *Brucella abortus*. It was later ascertained that this mare had slipped her foal the previous year.

The mare appeared to be making good progress, but developed a large fistulous wither. A course of vaccine treatment with *Brucella abortus* vaccine was given and the fistulous wither freely opened. The mare continued to make good progress.—*Major E. Wallace, R.A.V.C. (ret.)*, in *The Journal of the Royal Army Veterinary Corps* 10:2.

Canine Abortion and Human Paratyphoid

Veterinarians have long suggested that dogs are susceptible to human paratyphoid B infections and that under certain conditions they may be the sole source of transmission of this disease to man. Two years ago a local epidemic of paratyphoid was noted in an isolated Swedish village. Two weeks before the beginning of the epidemic a pregnant setter of the village had suffered a severe gastroenteritis and had aborted. After the development of the epidemic the local physician took samples of stools, urine and blood from the convalescent dog. The blood sample gave a positive Widal reaction with a standard laboratory strain of Salmonella paratyphi B (schottmülleri).

A year later a second local paratyphoid epidemic was noted in another isolated Swedish village. This epidemic also was accompanied with one or more cases of canine abortion. An atypical paratyphoid bacillus was isolated in the human cases. The dogs were not examined. As a precautionary measure, however, a valuable pregnant dog was sent from this village to an isolated farm about four kilometers distant. Two days after arrival the dog became desperately ill with enteritis and aborted. Following this abortion, four members of the rural family caring for the dog became ill with typical paratyphoid infection. Blood and stools were collected by the attending physician from the four patients and from the dog and sent to the National Laboratory at Stockholm for bacteriologic examination. An atypical paratyphoid strain was isolated from each of the five stools. All five blood samples gave positive agglutinin reactions with this strain, the canine serum agglutinating it in a solution of 1:250.

Theoretically the new microörganism may be pictured as a relatively primitive, less highly specialized type of the paratyphoid bacillus, a possible ancestor of more highly specialized strains isolated in strictly human cases. The cultural stability of this canine variant has not yet been tested.—Edt. in *The Jour. of the Amer. Med. Ass'n.* 112:15.

The Seven Wonders of Medical Science

It is through the use of the scientific method of controlled experimentation, which yields a knowledge of the fundamental principles of nature, that man during the past two centuries has achieved his present success in the battle against disease — a battle which, of course, is still under way. Only through a perusal of history may one gain an appreciation of the horrors of disease from which present-day civilization has been freed through the application of the discoveries of medical science.

The seven wonders of medical science may be described briefly as follows:

(1) *Anesthesia and analgesia,* which give us relief from pain and have liberated us from the pain of operations without anesthetics.

(2) Knowledge of the *germ causation of infectious diseases,* which has made possible the obliteration of the horrors due to cholera, plague, yellow fever, child-birth fever, typhoid, etc., from intelligent and well-governed communities.

(3) Our present knowledge of *immunity and body resistance to disease,* which would eradicate small pox and diphtheria from the face of the earth if put into universal practice. This also includes our knowledge of specific antisera against lockjaw, diphtheria, scarlet fever, rabies, specific meningitis, etc.

(4) *Antisepsis and asepsis,* a knowledge of which makes possible the prevention of wound infection and blood poisoning, and operations on all diseased organs.

(5) Knowledge of the *cause of symptoms,* which is based on a knowledge of physiology. Symptoms result when the physiology of an organ is disturbed and only when the functions of organs are known can disease of an organ be accurately determined. The use of x-rays helps tremendously.

(6) *Organotherapy,* which is based on a knowledge of physiology. For examples, we may cite the use of insulin in diabetes, thyroid extract in certain children showing undergrowth and poor mental development, liver extract in pernicious anemia, etc.

(7) *Animal nutrition and vitamins* as related to growth and the prevention of such diseases as rickets, scurvy, polyneuritis, pellagra, etc. Our knowledge of nutrition and the vitamins has also rendered it possible to increase our food supply, to prevent certain chronic diseases and malnutrition in children, and in times of economic depression to balance diets so that malnutrition may be prevented.—*Illinois Society for the Protection of Medical Research.*

* * * *

Just as oxygen, in combination with helium, has proved beneficial in the asthmatic type of case, so other gases will be found, which, in combination with oxygen, will form a basis of reasonable therapy in diseases in which inhalation therapy has not as yet been used.—*Mayo Clinic* 13:14.

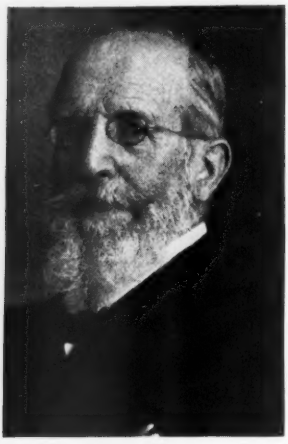
* * * *

Can Man Survive?

Since man came upon the earth he has on the whole subdued his vertebrate competitors in the struggle for existence; some he has eliminated; some have been rendered innocuous, a goodly number enslaved to his purpose, and with a few the battle still wages without advantage on either side. Against his parasitic enemies the story of his struggle is different. With his own parasites it is a standoff. With the parasitic enemies of his live stock he is waging what so far has been a losing battle, and his reverses are even more apparent in the contest with the enemies of his plants in the forest, field, and garden. Man prevailed over his vertebrate competitors when he learned more about them than they knew about him. He can win over the parasites that dispute his fitness to survive only in the same way; when he knows more about them than they know about their hosts. That time has not arrived, and Hall's statement in 1927 that we are losing the war against parasites still holds. More information about them—and not too long delayed—is essential to man's survival on this planet.

German Veterinarians Honored

During the last half-year, two outstanding German veterinarians were honored for their distinguished contributions to veterinary science on the occasion of their birthdays.



Theodor Kitt

■ November 2, 1938, Theodor Kitt celebrated his 80th birthday. From 1884 to 1932 he occupied the chair of pathology and bacteriology at the Veterinary College, Munich, Germany, his birth-place. Veterinarians from many foreign countries have received postgraduate training in his laboratory to prepare themselves for positions in their respective governments. Professor Kitt is well known as the author of textbooks: "General Pathology," the first edition of which was translated into English, "Special Pathology," "Microscopical Pathology," and an "Atlas of Pathology." On the occasion of his 80th birthday anniversary he was awarded the "Goethe Medal for Art and Science." This decoration has been bestowed upon very few distinguished scholars thus far, and therefore represents a most coveted honor in Germany.

■ March 24, 1939, Robert von Ostertag celebrated his 75th birthday. As author of the classical handbook of "Meat Inspection" he does not need an introduction to veterinarians in any country in which there is some form of food hygiene. Von Ostertag visited the United States in 1904, and again as recently as 1934, as German delegate to the 12th International Veterinary Congress in New York. In 1932, at the request of the governments, he visited the Argentine, Brazil, and Uruguay.

Von Ostertag was born in Schwäbisch-Gmünd, Suabia, Germany. He was graduated from the Veterinary College in Stuttgart at the age of 20. In 1885 he was appointed to the meat inspection service at the Berlin abattoir. In 1890 he founded the "Zeitschrift für Fleisch- und Milchhygiene." He is also co-editor of the journal *Ergebnisse der Allgemeinen Pathologie und Pathologischen Anatomie*. In 1892 appeared the first edition of his handbook on "Meat Inspection" which is now in its eighth edition. In the same year he was appointed lecturer on meat hygiene and parasitology at the veterinary college in Berlin.

In 1907 von Ostertag was appointed director of the veterinary department of the Imperial Ministry of Health. In 1930 he was appointed departmental President of the Ministry of the Interior in Suabia, a position of distinction which had not been held by any veterinarian previously. On the occasion of his 70th birthday, his bust in bronze was mounted in the Imperial Ministry of Health, next to the bust of Robert Koch. When the first German Veterinary Congress met in Berlin, June 17, 1937, a "Robert von Ostertag Plaque" was dedicated and conferred upon five outstanding veterinarians.

Robert von Ostertag

Von Ostertag is a member or honorary member of many veterinary, agricultural, and other scientific societies, both German and foreign, including the A. V. M. A. He holds honorary degrees from most of the German universities, and possesses many German and foreign decorations.

Veterinary Publisher Attains Three Score and Ten

Alex Eger, Chicago, celebrated his 70th birthday anniversary April 6, 1939. He was born in Hungary near Budapest, and came to Chicago in 1884 at the age of 15. In 1890 he was employed as clerk and later as registrar at the Chicago Veterinary College, a position he held for 15 years. His venture in veterinary publishing, to which he has devoted all his time since 1905, came about almost accidentally. Some of the students complained of the difficulty of taking notes during lectures. Young Eger, having time on his hands, attended the lectures with the students and took verbatim, shorthand notes of the lectures of Drs. A. H. Baker and E. L. Quitman, which he transcribed on the typewriter, making as many carbon copies as possible, and sold for $5.00 a set. The demand was unexpectedly large and the next year he multigraphed them. After three or four years the demand for his notes from students and alumni justified printing them, and lo, he was a book publisher. A copy of Frick's "Antiseptic Treatment of Wounds" fell into his hands and he translated and published it. Peter's "Meat Inspection" gave him a fourth title and Merillat's "Dentistry" a fifth. Resigning his position with the college in 1905, he added to his list rapidly Merillat's "Surgical Principles," Merillat's "Surgical Operations," Malkmus' "Clinical Diagnosis," Klimmer's "Hygiene," Leiserling's "Atlas," Kinsley's "Pathology," Scale's "Microscopy," Milks' "Pharmacology," Glass on the Dog, Kaupp's "Poultry Diseases," and others. At the same time he was exclusive American distributor for the works of Balliere, Tindall & Cox, leading London veterinary publishers, including Reeks' "Colic of the Horse," Reeks' "Foot of the Horse," Fleming's "Obstetrics," Ostertag's "Meat Inspection," Kirk's "Diseases of the Cat," Hobday's works, Lander's "Toxicology," and many others.

Mr. Eger's *magnum opus* was of course the publication of the English translation of Hutyra and Marek, of which three editions appeared, totalling 5000 sets.

For many years Mr. Eger attended all meetings of the A. V. M. A., the Missouri Valley Veterinary Association, and many state veterinary meetings. For the last 10 years or longer, poor health has precluded traveling, but his acquaintance is still large among the older members of the veterinary profession, who wish him many more years in the veterinary book business.

* * * *

Apple Powder for Intestinal Disorders

The therapeutic value of apple pulp in treating certain intestinal disorders has long been recognized. It has, however, some mechanical and esthetic difficulties in preparation and administration. These difficulties have been largely overcome by the development of an apple powder, which retains the beneficial properties of the apple pulp, but is capable of being stored and of being administered with greater ease and precision. Case reports have indicated that apple powder, administered in milk or water, has a definite value in controlling diarrheas, dysenteries, and the like, in both infants and adults.—*R. de R. Barondes, M.D.*

* * * *

How Drugs Cure

A drug may assist a patient in his battle against invading bacteria: (1) by making the patient's tissues an unsuitable culture medium, bacteriostasis; (2) by killing the bacteria, a bactericidal or bacteriolytic effect; (3) by increasing the number of leucocytes, and hence presumably the number of phagocytes; (4) by increasing the effectiveness of the existing phagocytes, enabling them to engulf and inactivate or kill a larger number of bacteria by increasing the opsonins in the patient's serum; (5) by inactivating the toxin produced by the bacteria, an antitoxic effect; (6) by making the tissues of the patient less sensitive or less susceptible to injury by toxin; (7) by causing the organism to assume less virulent forms, dissociation.—*E. F. Traut* and *C. E. Logan,* in *The Journal of Laboratory and Clinical Medicine* 24:6.

Damages Allowable for Loss of Animals

By LEO T. PARKER, Cincinnati, Ohio

The purpose of this article is to review concisely the leading higher court cases on the subject of valuation of animals. Although the majority of these cases relate to animal losses not the result of improper treatment by veterinarians, most of them are applicable to situations in which veterinarians are sued for damages following the death of animals treated by them. Court citations are included so that veterinarians who have litigations of this nature, may have available court citations that will assist in winning suits.

First, it is important to know that the courts have often held that the sale or market value of an animal is a proper measure of the damages allowable for its loss. See: 213 Ala. 15; 119 Ark. 120; 128 Ga. 631; 66 Ill. 309; 115 Miss. 598; 190 S. W. 29; 154 N. Y. S. 333; 81 Tex. 222. In all these cases the court held that under all circumstances the valuation of an animal is the price at which it will sell.

Another important point of the law is that the value of an animal wantonly and maliciously killed or injured may be proved in the same way as that of any other property. Usually this is accomplished by evidence that the animal was of a particular breed and had certain valuable qualities, and by the testimony of witnesses who know the market value of such animal. In order to prove the market value of a dog, the breeder who had sold it was permitted to state the price for which the dog sold when it was six months of age, although it was more than three years old when killed. Also, the trainer and breeder was permitted to testify as to the demand and normal value of such dogs and to estimate what the dog actually was worth. (77 S. W. 901.)

In a leading case (154 N. Y. S. 333) a veterinarian who treated a well-bred French poodle testified that there was no good market at that location for such dogs, but that he knew of sales of that breed in the nearest market and that its reasonable good market value was from $150 to $200. The court, in view of this testimony, held the market value to be $155, and this amount was allowed as damages.

Actual Value

On the other hand, frequently the courts will allow damages based upon the actual value of the animal to its owner. In other words, in some instances it has been held that the proper measure of damages for an animal is its worth to the owner.

Various courts have held that testimony of owners as to the value of their animals may be introduced to prove the actual value, particularly where evidence of the actual market or sale value is not available. For cases involving this point, see: 208 Ala. 319; 159 Iowa 514; 109 Mass. 273; 96 Mich. 236; 77 Miss. 353; 117 Mo. App. 691; 100 Tenn. 317; 81 Tex. 222.

Owner's Valuation

Obviously, it is frequently the case that the owner of an animal would prefer to prove the animal's actual value to himself, rather than the market valuation or sale price. For example, in Winchell, 64 Vt. 15, it was argued that the owner of a dog that had been killed maliciously is entitled to recover only its market value. However, the court held that the owner is entitled to prove its actual value to himself, the dog being a Gordon setter that was eligible to registration. (Also see 96 Mich. 236.)

In another case (159 Iowa 514) the court received testimony of the actual value of a collie dog that was caught in a trap and killed. The testimony of its value was given by persons who knew its habits and character as tending to prove that it was very valuable, highly trained and highly efficient about the farm. In view of this testimony about $100 was considered to be its actual value.

Therefore, it seems to be well-established law that if there is no market value in the

immediate locality for an animal, testimony will be received by the court as to the value of the animal to its owner.

In Heiligmann V. Rose, 16 S. W. 931, it was held that the damages allowable for killing an animal could be measured either by its sale or market value, or by reference to the special pecuniary value to the owner. This value may be ascertained by reference to animal's usefulness and services.

Frequently, in litigations involving suits in damages for the death of, or injury to, an animal, the person who files the suit endeavors to increase the valuation by claiming sentimental value. The courts positively will not allow increased damages on this plea.

* * * *

Livestock Often Poisoned by Eating Water Hemlock

Farm animals—mostly cattle—often die in early spring after eating water hemlock which grows in swamps and wet meadows and is frequently abundant along irrigation ditches. The plants, of which there are several species, are considered the most poisonous in the United States. The species common in the Eastern states is sometimes known as the spotted water hemlock. One which causes losses on the Pacific slope is called the tuber water hemlock. The different hemlocks are sometimes erroneously known as the wild parsnip.

Symptoms of water-hemlock poisoning in cattle are frothing at the mouth and violent convulsions which usually result in death within a short time. No effective remedy is known. The only means of prevention is to keep animals from eating the plants.

The plant usually may be identified by an examination of the rootstock and leaves. The poisonous species grow from rootstocks to which are attached roots that may be small, as with the tuber water hemlock, or may be thick, fleshy tubers as in the spotted water hemlock. The rootstock, cut open lengthwise, shows a number of transverse chambers, a characteristic which, however, occurs in a few other plants. The leaves are divided into leaflets, each of which is pointed and more or less saw-toothed along the edges. Branches of the leaf veins run toward the notches between the teeth.

Cattle in grazing eat off the top portion of the rootstocks, or the entire rootstocks that have been thrown out when cleaning

WATER HEMLOCK (Cicuta Maculata)

The spindle-shaped rootstock and lower stem, the leaves, flowers and fruit are shown three-eighths natural size; also a cross-section of seed X4.—U. S. Dept. of Agriculture.

ditches or that have been washed out by water from higher elevations. Only a small quantity of the rootstock may kill any animal that eats it. The tops of the plant probably are poisonous in early growth, but experimental feeding has shown conclusively that neither the tops nor seeds of mature plants cause losses.

* * * *

A majority of intestinal parasites are dependent upon the soil for their propagation and existence. A combination of contaminated soil and infested animals is the complex that farmers must combat. A common error in handling the parasite problem is in treating the infected animals and giving little attention to the contaminated surroundings. Both must receive consideration in any well-balanced program of control.—*Robert Graham.*

Memphis Meeting of the A. V. M. A.

VISITORS to the A. V. M. A. Convention to be held in Memphis Aug. 28-Sept. 1, 1939, will find themselves in the very heart of "de land ob cotton". The snowy-white fiber, of the greatest economic importance to the South, has world-wide ramifications; the industry employs many thousands of workers, from the darkie sharecroppers and cotton pickers to the employees and executives of the vast network of cotton exchanges, and of the large textile factories throughout the world.

Ready for Picking

The picking season commences just at the time of the convention, and northern visitors who have never before had an opportunity to see cotton "in the raw" will find the busy, picturesque scenes in the cotton fields a fascinating sight.

Memphis is the largest inland cotton port in the world, and much of the product goes through the Memphis Cotton Exchange. Along cotton row, room after room contains thousands of cotton samples representing bales which have been stored in some compress or warehouse. Buyers come here from France, Germany, Japan and elsewhere. While purchases are made in foreign currencies, the skilled efficiency of the cotton market makes it possible for the producer to be reimbursed immediately in dollars. For the year 1938, gross receipts at Memphis were 2,719,180 bales. The sales totaled 2,195,076 bales. The value of the net receipts for 1937 was $88,353,628.

Possibly of greater interest to veterinarians is the horse and mule market at Memphis, one of the largest in the world. Mules are used extensively in the cotton fields; because of this, and because Memphis is the logical gateway from the South and Southeast to the North and West, this city is the largest distributing center for horses and mules in the United States.

The yards are extensive, the mule yards alone covering an area of 18 acres. The trading season begins in August and lasts until May each year; during that period, thousands of mules are bought and sold through the firms of Owen Brothers, Edward Brothers, and Smith & Podesta, and this means millions of dollars in the pockets of the farmers in the producing territory. The large number of animals passing through the market also stimulates the sale of hay and grain.

Such horse teams as this are always in demand in the Memphis market, but mules are preferred for work in the cotton fields.

The cotton fields and the horse and mule market are two of the sights which visitors to the A. V. M. A. convention will not want to miss. Activity in both begins in August, and is in full swing during the time of the convention.

The Round Table

There are many common, every-day questions asked the average practitioner. In most instances, the answers to these questions are not available in texts, and when they are available, individual interpretations often result in conflicting answers to clients who "shop". A series of comprehensive answers would, I have no doubt, aid the veterinary profession in establishing uniformity of advice to its clientele.

It, therefore, appears that a discussion of these controversial matters will be beneficial to the profession at large and especially to the recent graduates, who are all too often "stumped" by non-academic questions. Such a discussion might also include credits, business policy, client psychology, etc.

I include random questions, practically all relating to small animal practice, for a starter. Others no doubt will want to propound questions pertaining to the field of farm animal and poultry practice, with which I am unfamiliar.

Here are my questions. I invite those who know the correct answers to send them in to the Round Table column for publication.—*J. A. Coad.*

1. *"Doc, you're the third vet I have talked to about distemper vaccination, and you've each told me a different story. Whoinell am I to believe?"*

2. *"Now, doctor, I don't want to spend too much money on this case, so if you can't do anything we might as well get rid of him."*

3. *"I'm telephoning for a neighbor who wants to know how much it costs to fix a dog's broken leg."*

A reply that it depends upon the leg is usually unsatisfactory to the owner of the dog, while a reply "bring him in and let me look at it" sends him elsewhere.

4. *"I'm telephoning for a neighbor who wants to know what to do for a dog with mange."*

This man doesn't want a dissertation on skin ailments. What short, concise answer will produce the dog for examination?

5. *"Doctor, I hate to bother you so much, but how is little Fifi?"* (4 p. m.—fourth call today.)

6. *"My dog doesn't feel good. I think she needs worming."*

7. *"How old should a pup be before I bathe him? What kind of soap should I use? How can I keep him rid of fleas?"*

8. *"Doctor, did she eat? What kind of food do you feed your dog? What do you think about feeding canned dog food?"*

9. *"How often should a dog be wormed?"*

This question, and the preceding three, may be going the rounds. If, say, four practitioners give four substantially different answers, it looks bad for all of them.

Vomiting in Cows

With respect to the discussion of vomiting in cows (*Vet. Med.*, April, 1939, p. 203; May, 1939, p. 321), I would like to report that I have had some cases which were not due to foreign objects in the esophagus.

One of these was a four-year-old, Holstein cow on a record test for production. This animal was vomiting large quantities of ingesta, sour-smelling and containing much fluid. The temperature was 104° F., and the milk flow had diminished to only four pounds a day. My diagnosis was simply over-acidity. I advised the owner not to crowd the feeding, and to feed more roughage, and prescribed the following:

℞

Sodium bicarbonate 3ss
Ginger 3ss
M. et ft. caps.
Sig. Give one capsule three times a day.

I also advised feeding one pound of molasses three times daily.

The cow stopped vomiting in about three hours, and was back to normal the following day.

In this case there was clearly no foreign object in the esophagus.

G. F. YAGER

Sauk Center, Minn.

Milk Hygiene in the United States*

By WARD GILTNER, East Lansing, Michigan,
Dean of Veterinary Science, Michigan State College of Agriculture and Applied Science

THE American people consume a great deal of milk and milk products. This statement applies not to special groups—geographical, social, economic, age, rural or urban—but generally, and is explained by the fact that agricultural conditions favorable to dairy husbandry prevail in all parts of the country so that a generous supply of fluid milk is available to nearly all the people, while exceptionally favorable conditions for dairying in some sections make possible an abundant supply of dairy-manufactured products. America can supply all the milk and dairy products that her people can consume. Well-developed means of transportation make it possible to ship fluid milk great distances in time to reach the distributors with its keeping quality unimpaired. An elaborate system of agricultural education, research, and extension has helped the dairy farmer to produce a superabundance of milk. Dairy technology has supplied an elaborate equipment for handling milk economically, expeditiously and safely. The people of all ages have been educated and propagandized to a liberal use of milk, and although there are many Americans who do not consume as much milk as they should for reasons of economics, inertia, or personal taste, the per capita consumption of milk in the United States is high.

The United States Department of Commerce census of 1935 gives the following facts relative to the nation's dairy business: The number of cows milked increased from 21,124,221 on 4,615,529 farms in 1929 to 24,581,669 on 5,236,885 farms in 1934. Eight states reported over a million cows milked in 1934. For the country as a whole, 76.9% of the farms reported milk production, as against 73.4% in 1929. However, the production of 10,666,065,473 gallons of milk in 1934 was 3.5% below that of 1929. The average production per cow was 434 gallons in 1934 compared with 525 gallons in 1929. (The major portion of this decrease was no doubt due to the unprecedented drought of 1934.)

With this large-scale production and wide consumption of milk, the problems of milk hygiene are ever present.

■ Some technical procedures practiced to a limited extent deserve mention. Irradiation of milk has a limited vogue. The processes are patented and royalties added to the increased cost of production raise the price of milk by at least 10%. It is necessary to bio-assay the milk for vitamin D and determine whether the irradiation has produced the required number of units. There is evidence that not all the irradiated milk on the market meets the standards. Even in communities where irradiated milk is sold, its use probably does not exceed a fraction of one per cent of the total supply. It is not considered an adequate substitute for cod-liver oil or sunshine.

Homogenization is practiced to a limited extent, but the interference with the cream line militates against the popularity of this procedure. However, with the increased use of opaque paraffined paper containers, there may be an increased use of this practice.

Condensery products are used extensively in the United States, both because some places are remote from a fresh fluid milk supply, and because of the facility with which the product is marketed and stored. There is evidence that milk of low grade, rejected by the more fastidious purchasers or excluded by legal restrictions, finds its way into some of the condenseries. There is need for more supervision of the milk supply of the condenseries. It is too easy in some communities for the milk producer to find a market for his product regardless of the fact that it may be rejected by many

*Presented to the XIII International Veterinary Congress, Zurich, Switzerland, Aug. 24, 1938.

municipalities as well as by the more reputable creameries.

■ The problem of milk hygiene involves efforts directed toward securing for all the people, (1) an abundant supply of milk and its products, (2) milk and milk products that meet reasonably high standards of quality as determined by both subjective and objective tests, (3) milk and milk products that are safe—free from dangerous alterations or additions. In the United States these objectives, as with all health objectives, are measurably attained by the combined action of (1) personal, (2) public or legal, and (3) semi-public agencies.

The federal government concerns itself largely with the regulation of importations. However, there are several federal departments and bureaus that make contributions to a better and safer milk supply. The Bureau of Animal Industry of the federal Department of Agriculture has engineered and coördinated the great and nearly completed campaign of eradication of bovine tuberculosis, has made a good beginning toward a similar battle against Bang's disease, and has made some preliminary attacks on mastitis. The Bureau of Dairy Industry of the same department is constantly adding to our knowledge of milk production, distribution, and dairy manufacture. The United States Public Health Service of the Treasury Department has for many years interested itself in helping the people, especially of the South, to obtain a satisfactory supply, and in protecting them from the dangers of milk-borne diseases. The Standard Milk Ordinance of the U. S. Public Health Service, while not universally accepted without reservations, has been an aid to milk hygiene. Under the provisions of Title VI of the Social Security Act, authority is granted for federal appropriations to aid states, counties and health districts in establishing, maintaining and improving the health services, in training personnel and in research.

The position of the U. S. Public Health Service with respect to milk hygiene is stated in a letter to the writer: "For its milk investigations the Public Health Service employs not only veterinarians but also sanitary engineers, bacteriologists, and dairy industry graduates. It feels that all of these professions have their place in milk control.

"On the other hand, the fundamental training which has been received by sanitary engineers is better adapted to the supervision of the design and operation of pasteurization plants than is the fundamental training received by dairy industry graduates, bacteriologists, or veterinarians. The electrical and mechanical equipment and thermostatic control devices used by pasteurization plants also demand engineering training in order to insure technically correct supervision.

"For dairy farm inspection, however, it is felt that either veterinarians, dairy industry graduates, or sanitary engineers may be employed with practically equal success, and it is not thought that any of these professions should be barred from such work any more than that the veterinarians should be barred from pasteurization plant control."

Until passage of the Social Security Act, the rôle of the federal government in milk hygiene was not conspicuous. Milk and milk products passing from one state to another were subject to the sanitary regulations of the receiving state, which freely sent its inspectors into the plants and into

The session of the XIII International Veterinary Congress devoted to a discussion of milk hygiene was one of the best attended sessions of the Congress, an indication of the worldwide interest of veterinarians in this subject. The consumption of milk in most countries is far below that deemed desirable by nutrition experts. It is agreed this will be remedied only when the palatability of market milk is improved and confidence in its wholesomeness more widely established.

the farms of the sending state. Economic conditions, together with lack of central authority, have been the determining influence on milk quality so far as interstate shipment is concerned. In most communities there is a competitive market for milk and cream. If the sanitary and hygienic requirements of one buyer are too severe, another buyer with fewer scruples can be found. This applies especially in the cases of cream and milk for condenseries. But it also applies in cases where a large city with a fairly rigid inspection picks out the good milk and leaves the questionable supply for consumption by the local community, which frequently maintains no hygienic supervision over the dairies.

■ In the United States public health laws and regulations derive their validity from police power, which constitutionally resides in the state governments. In the state administration the authority for milk hygiene may be vested in (1) the Department of Health, (2) the Department of Agriculture, or (3) some special department. The special Committee of the American Veterinary Medical Association on Food Hygiene reported in 1937 on the distribution of milk hygiene control in these departments of the 48 states as follows:

State Health Department	22 states
State Agricultural Department	12 states
State Health Department and some other agency	10 states
Some department other than health or agriculture	4 states

Sanitary engineering and dairy departments are most frequently used for milk sanitation work. State bureaus of animal industry and state veterinarians are in charge of this work in only three instances. As Merchant has pointed out, the trend is toward health department control of milk sanitation. Veterinarians comprise 13.2% of the 282 state milk inspectors, while agricultural graduates and sanitary engineers comprise only 5.3% and 2.5% respectively. Of the remainder the less said the better—for the states employing them.

State control of milk hygiene in the United States is decidedly imperfect and does not involve a system of inspection and the maintenance of a corps of inspectors adequate to cover either the producer units or the milk plants. In some states the state control is exercised vigorously, in others practically not at all, and in still others there is coöperation between the state and local health authorities.

■ The protection of the urban dwellers from milk-borne diseases and the responsibility for the quality of the milk supply is usually a municipal function. This is indicated by the following data: Of 706 municipal milk inspectors (as against only 282 state inspectors) 22.8% were veterinarians, 14.2% medical graduates, and 2.4% sanitary engineers. About half of the state and municipal inspectors appear to have had no professional training whatever, unless in this country pap-sucking be regarded as a profession.

With conspicuous exceptions, only in the larger municipalities is milk inspection adequate. For the smaller municipalities and rural populations no satisfactory milk hygiene control has been worked out generally. Probably county and district health units offer the most hopeful solution of the milk hygiene problem in rural places and the smaller cities. During the period from 1908 to 1934, inclusive, health units were established, according to the U. S. Public Health Service, in 811 counties out of the 3096 counties in the United States, but by 1934 there were only 581 counties remaining with a full time health service. However, by 1936 this number increased to 946.

■ Financial support of county and district (two or more counties) health units comes from the federal, state and county governments, and from private sources. In southwestern Michigan, the W. K. Kellogg Foundation has contributed to the establishment and operation of adequate health departments in seven rural counties. The Foundation has coöperated with Michigan State College and with Cornell University in holding short courses for veterinarians from these counties. It is the plan of the Foundation to have all veterinary practi-

tioners who practice in these counties participate in the health department program in the following ways:

1. To make physical examinations of cattle on dairy farms from which milk is sold directly or indirectly to the public within the county.

a. The first object of such physical examination shall be the detection and elimination of diseased animals from the dairy herd.

b. The second shall be educational in nature with an effort directed toward informing the dairyman regarding the importance of disease-free animals both from the public health and economic aspect.

2. To make ante-mortem and post-mortem examinations of animals and carcasses, the meat from which is intended for sale for human consumption.

3. To make inspections of slaughtering and retail meat establishments for the purpose of detecting unwholesome meat or meat products, and to inspect the general sanitary conditions of the premises.

a. The inspection of slaughterhouses and markets is for the purpose of insuring sanitary surroundings where slaughtering is done and meat products processed and sold.

4. To give talks before groups, organizations or clubs, as requested, upon subjects such as health of dairy cattle, milk sanitation, slaughtering inspection and other subjects in line with professional veterinary work which may affect the public health. No charge shall be made for talks of this type.

■ Probably the American people are indebted for a good milk supply more to private efforts than to official inspection. The highest quality of milk produced and sold in the United States is certified milk. This milk is certified to by local medical milk commissions that have a legal and official status. It is illegal to state, indicate or advertise any milk as certified except that which has been certified to by a medical milk commission. Certified milk is theoretically produced under the most rigid sanitary and hygienic conditions practicable with respect to the health and cleanliness of the cows and employes, the cleanliness of the utensils, stables and milk houses, and the care and handling of the milk until it reaches the consumer. As a matter of fact the procedures in the production of certified milk can hardly be termed practical. The price of the product is approximately double that of grade A market milk, and only an insignificant amount is produced. Certified milk has until recently been marketed raw, although cattle in certified herds have not always been free from tuberculosis, Bang's disease or mastitis, and diseases of human origin also have been traced to the use of certified milk. Pasteurization of certified milk is now permissible.

Ward Giltner

■ There are many large milk companies in the United States which maintain a higher standard of milk hygiene than is required by governmental agencies. Veterinarians are employed privately to inspect herds and enforce stable and milk house sanitation. Efforts are made to eliminate possibilities of human sources of infection. At the receiving stations milk is subjected to expert testing for temperature, odor, methylene blue reduction, sediment, and bacterial count. Some of this milk is sold raw, but most of it is pasteurized.

In general, the larger producers voluntarily maintain higher standards or more readily submit to official regulations. The small producers are frequently without capital, suitable equipment, or adequate training in sanitary milk production. It is this type of producer that is responsible for much of the trouble in the milk business both from a hygienic and an economic standpoint. In many communities he can find a market for his product, no matter how bad it is, in the condensery or creamery if not in the fluid milk market, of some small town that maintains no inspection service.

Such a condition is a strong argument for rigid, universal, state control of milk hygiene, but it is a fundamental tenet of

American jurisprudence that a law or regulation cannot be effective in the absence of public opinion to support it. Hygienic standards for milk and its products are built from the bottom up, not imposed from the top. Pasteurization was made popular by Nathan Straus and by manufacturers and users of pasteurization equipment, and not by city ordinances. An abundance of good dairy products has been made available by private initiative and not by law.

■ Opinions seem to differ as to what is fundamental in milk hygiene. The veterinary hygienist insists that the healthy cow is the basis for a good dairy product. Other groups place emphasis on stable and plant sanitation or pasteurization. It is practically common law in the various states that milk shall be marketed only when it comes from a healthy cow. The enforcement of this law is exceedingly flexible. The interpretation of what constitutes health of the dairy cow is variable. The cattle disease problems in the United States are handled by federal quarantine of exotic plagues and their eradication by combined federal and state attack when they gain entrance, as in the case of foot-and-mouth disease. Tuberculosis has been reduced to negligible proportions throughout the country except in one state in the far West. The menace of milk-borne tuberculosis in children has disappeared. Bovine tuberculosis has not been eradicated and only eternal vigilance will keep it suppressed. Bang's disease is being attacked cautiously along lines similar to those so successful in the tuberculosis campaign. The percentage of reactions to the blood agglutination test for Bang's disease is running from two to three times the number that reacted to the tuberculin test. The use of the rapid plate test introduced by Huddleson has made field testing eminently practicable. It is not known how many human cases of brucellosis occur annually in the United States; over 2000 are reported to the U. S. Public Health Service annually, and it is conservatively estimated that there are actually ten times this number. What percentage of these cases are milk-borne is not known; but it is very high in the East and South, where *Brucella suis* and *Brucella melitensis* are rare.

Mastitis in cattle occurs about twice as frequently as Bang's disease. In a survey of the Lansing, Michigan, milk shed by Bryan, 86% of the herds and 26.2% of the cattle were infected with streptococcic mastitis as determined by Bryan's microscopic examination of properly collected and incubated samples. This milk shed supplies over 100,000 persons and may be considered as typical of those supplying most American communities. The researches conducted by our associates convince us that about 99% of all cattle mastitis is infectious, of which about 99% is caused by streptococci; that about 95% of streptococcic mastitis is due to *Streptococcus agalactiæ;* that not all herds and certainly not all cattle are infected; that the disease can be diagnosed early, easily, and accurately by Bryan's technic; and that the disease is controllable. There is constantly accumulating evidence that milk from cattle infected with *Str. agalactiæ* is the cause of streptococcic sore throat and other infections of humans. We believe that a milk supply can be greatly improved in both quality and safety by a persistent campaign of physical examination of the udders of milking cattle and by the testing of the milk from each quarter of all the milk-producing cows, using various physical and chemical tests; but we do not believe that such procedures will eliminate the streptococcus from infected herds. It is reported that veterinary practitioners of New York State are receiving about half a million dollars annually as a result of their efforts to clean up mastitis in that state by means of physical examinations supplemented by such aids as the sedimentation test, the brom-thymol-blue test, and the chlorides test.

■ Control of milk-borne diseases of human origin has progressed with respect to efforts to prevent contamination of milk by

human pathogens. However, milk-borne epidemics of typhoid fever, streptococcic sore throat, and scarlet fever still occur. Frequently the contamination originates in the desire to keep some semi-invalid or convalescent busy at the lighter tasks of milk production rather than heavier farm labor. The practicability of universal examination of all food handlers is questioned, especially if it involves the application of all the usual laboratory procedures. It seems practical, however, to guard water supplies and to warn against permitting any person with sore throat or suspicious gastrointestinal symptoms to work in any phase of milk production or distribution. This must be an educational campaign backed by official quarantine and isolation when cases are actually diagnosed. Epidemiological work is practiced by most state and large city health departments in an effort to determine whether an epidemic is milk-borne, and if so to locate the exact offender responsible for the trouble. In the case of typhoid carriers pressure is exerted to keep them out of all food handling business and even to have them submit to cholecystectomy. Thus in Michigan, where in 1935 two milk-borne outbreaks were traced to carriers, 161 carriers have been located and 18 cholecystectomies have been performed.

Unless a constant and competent inspection prevails, the only safeguard against human milk-borne infection is pasteurization. This applies also to infections of animal origin, although in some sections of the United States it has been possible to supply a raw milk without danger of transmitting the diseases of the dairy cow to man. Pasteurization should not be necessary so far as diseases of the dairy cow are concerned; but animal disease control has not yet progressed far enough to make pasteurization unnecessary. The control or eradication of infectious diseases of the dairy cow is considered desirable and practicable because (1) the milk is safer, (2) it is produced more economically, (3) its quality as determined by organoleptic tests is better. With human infections it is quite different. The presence of the human pathogen does not alter the quality—only the safety—of the milk.

The protection of milk and dairy products from contamination by human pathogens can be furthered by any means whereby all the dairy employes are thoroughly instructed in the fundamentals of infectious disease transmission and in the essential personal habits and practices that will effectively block such germ transfer. This is not primarily a job for the regulatory officer, but it is a job that probably will not be done except under the guidance of the health authorities. Fabian has advised schools of instruction for dairy plant operators and certificates of proficiency, together with the licensing of the operator. It is not yet clear how far it is feasible to go in this direction.

Summary

The United States has an abundant milk supply, on the whole fairly good; in most large cities and in some states very good and reasonably safe; but in many rural communities neither safe nor satisfactory. Due to the decentralization of the government, milk hygiene control is usually exercised only in communities that have been educated to demand it. About half of the milk inspectors have had no professional training for their work. Of the professionally trained personnel, the veterinarians are the most numerous. It is the opinion of the veterinary profession that the veterinarian is the only professionally trained man who is capable of functioning in connection with all the details of milk hygiene and sanitation from the cow to the consumer. In order to insure a safe and satisfactory milk and dairy products supply, it is believed that, in addition to requiring the application of all sanitary precautions to the environment, every reasonable precaution should be taken to limit the supply to the products of healthy cattle produced by a personnel that includes neither carriers nor those clinically affected with the germs of milk-borne disease. Finally, pasteurization is considered an essential safeguard, but only when the milk has been produced under reasonably satisfactory conditions.

Milk Hygiene in Great Britain*

The production of the ideal hygienic cow's milk, destined for human consumption, is greatly hampered (at any rate in Great Britain) by the continued prevalence of two cattle scourges, viz., tuberculosis and contagious abortion.

The eradication of these diseases is of great practical importance, not only from the public health point of view, but also from the economic agricultural aspect.

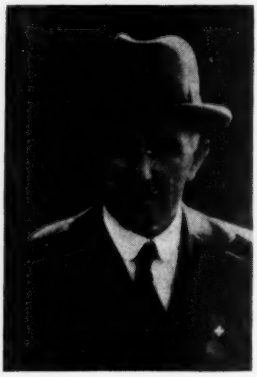
During the past 15 years the public health authorities in Great Britain have made great advances in the hygienic control of milk, after it is taken from the cow, and have given serious consideration to the production of what is popularly known as "clean milk." Their efforts have been directed to the treatment of milk after it is removed from the cow, but no wide-spread, serious efforts have been directed to the removal of fundamental causes of much dangerous milk, the diseases of the cow.

The logical method of ensuring a safe milk is, first of all, to eliminate the diseases of the cow. Healthy cows, kept under hygienic conditions and properly fed, produce a wholesome milk.

Through the establishment in recent years of the Milk Marketing Board of England, which controls the supply and price of milk and extends its use as a food by advertising its great nutritive value, the demand for milk, especially for children, has rapidly increased, and one result is that the general public has become more directly interested in the production and clean handling of milk.

It is unfortunate that this easily digested article of diet is such a favorable medium for organisms and readily acts as a carrier of pathogenic organisms capable of infecting man.

The efforts of the Public Health Authorities in Great Britain have hitherto been directly concerned with establishing and maintaining hygienic byres, dairies, milk utensils and containers, but unfortunately there has been a lack of equal attention being paid to the health of the cow, and in order to render the milk "safe," the authorities have concentrated on the pasteurization of the milk marketed, rather than the elimination of diseases from the milking herds. Thus the immediate public health views have been enforced without due consideration being given to the fundamental agricultural side of the problem, the elimination of the diseases from the producing cow.



Maj. Brennan de Vine, President of the National Veterinary Medical Association of Great Britain and Ireland, at the XIII International Veterinary Congress

Owing to the fact that pasteurized milk has been semi-officially declared a safe milk and has been advertised and popularized as such by the large milk retailers, it has been accepted by a large proportion of the general public as being ideal. This is unfortunate, as such an acceptance has proved a deterrent in schemes organized for eliminating the diseases of the cow, which are the root causes of many of the disadvantages of milk as a human food. While the general public continue to believe that pasteurization renders all milk safe, there continues a lack of public support for plans to eradicate the diseases of milking cows.

Since pasteurized milk has been so universally accepted by the consumer, pasteurizing plants, many of which are not efficient, have been installed in dairies throughout the country, with the result that the cow owner does not receive sufficient stimulus or support to carry out erad-

*Some paragraphs from a paper presented to the XIII International Veterinary Congress, Zurich, Aug. 24, 1938, by Major Brennan de Vine, MC., FRCVS., DVSM., Chief Veterinary Officer, City of Birmingham Veterinary and Food Inspection Department, Birmingham, England.

ication of bovine diseases, particularly so in the case of tuberculosis and contagious abortion of cattle.

Tuberculosis and contagious abortion are as rampant in our dairy herds today as they were twenty years ago; yet if these diseases were eliminated, not only would the financial position of the herd owners be improved, but the general production of milk and meat would be more economic for the nation generally.

I feel that the fact that the medical profession has wholeheartedly backed the pasteurization of milk and instructed the general public that pasteurized milk is safe, has brought about a lack of enthusiasm for support for the agriculturalist in the eradication of disease from our herds.

Wood Ticks Abundant in May and June

In the last few years an increasing number of cases of Rocky Mountain spotted fever have been reported in the East. It has appeared in nearly all states except those in New England, and Ohio, Michigan, Wisconsin, and Mississippi. A number of cases of this tick-borne disease occur each year in Maryland and Virginia in the vicinity of Washington, D. C., and also in North Carolina, Delaware, Pennsylvania and New Jersey. In the far west, spotted fever is carried by a different species of tick, not the American dog-tick.

From the standpoint of wood tick infestation, May and June are the worst months for camping or hiking in regions where these insects are abundant, according to Dr. F. C. Bishopp of the U. S. Department of Agriculture.

Ticks live on blood obtained by attaching themselves to animals or human beings. A tick bite may result in nothing worse than a local irritation, or it may serve as a point of entry for serious bacterial infection of some sort. The common dog-tick or wood tick is frequently a disease carrier. Rocky Mountain spotted fever, which has a high mortality, is the most widespread and most dangerous of the tick-borne diseases. But some species of ticks also have been known to carry tularemia, or rabbit fever; and others, mainly in the West, a disease called relapsing fever, and a peculiar form of paralysis.

Although adult ticks prefer the blood of dogs, they may attach themselves to horses, cattle, and larger wild animals, as well as to man. The young ticks relish the blood of meadow and pine mice and other small wild animals. When there are none of these little animals on which the young ticks can feed, they disappear. Clearing out underbrush near houses, camps, and frequently-used walks cuts down the number of ticks by removing shelter for their hosts. If ticks are very abundant near a permanent camp site, a creosote oil spray on the area around the camp and along the trails may help to kill vegetation and repel them to some extent.

It is best to confine dogs in yards throughout the tick season, and examine both dogs and horses frequently. Doctor Bishopp recommends pulling ticks off these animals with forceps or tweezers and dropping them into a can of kerosene. This avoids handling them. Ticks that have fed on a dog for a few hours are immediately dangerous if they bite a person; but they are not likely to detach until fully fed and the engorged females will not reattach. As the Rocky Mountain spotted fever disease can be contracted from crushed ticks, through cuts or scratches, it is a safety measure to wash the hands thoroughly after touching ticks. Derris powder may be scattered lightly over heavily infested dogs. This kills any ticks on the dog and tends to repel others. Since each engorged female tick that escapes will deposit about 5,000 eggs, the importance of killing every tick on a dog is emphasized.

If it is necessary to go into tick-infested places it is advisable to wear high-top shoes over army type trousers and systematically to examine the body and head at least twice a day. Ticks often attach themselves in the hair at the base of the scalp. They are not likely to transmit disease unless they remain attached at least six hours.

"Secondary" Disease Occurring Subsequent

A TRUE definition of "secondary" or "X" disease is impossible, since the exact cause and nature of the disease are unknown. As here referred to, the disease is that first reported in the United States by Madsen[1] in Utah, where it appeared following the 1933 epizoötic of infectious equine encephalomyelitis.

Symptoms

Clinically it is characterized by (1) intense icterus, (2) intestinal atony and retardation of urination, (3) absence, or rare occurrence of fever, and (4) nervous symptoms varying from depression or stupor to mania. Violent cases, when restrained in the stall, display a characteristic spraddling stance with continuous efforts to push forward. When unrestrained the animal pushes into obstacles with abandon and severe bruising results. Some cases become so violent as to make treatment almost impossible. Many cases develop a severe hemoglobinuria. Walking in circles, as seen in infectious equine encephalomyelitis, sometimes occurs. Some reports indicate that the disease does not occur in animals under two years of age. Although the onset of the disease may be gradual, its course in severe cases is rapid, commonly resulting in death in 12 to 48 hours. Clinicians, however, generally report recovery in those animals in which prompt, liberal intestinal evacuation is obtained. If this fails, death results in the majority of instances. Recovery from a protracted illness is reported to result frequently in stupidity and intractableness.

Lesions

At autopsy, an extreme, generalized icterus is constant. Evidence of dehydration is found. The liver is enlarged, friable, and paler than normal, with the gross appearance of parenchymatous degeneration. The kidneys may be somewhat darker than normal, slightly enlarged and congested, and often petechiate. The spleen is normal or only slightly enlarged and congested, except in a few cases where the organ is much enlarged. The stomach and various portions of the intestines, chiefly the small, are usually hyperemic or actually hemorrhagic. Petechiæ or ecchymotic hemorrhages are commonly found in the serosæ of one or both body cavities. Intramuscular hemorrhages may be present. The brain appears normal, although some observers report an increase in cerebrospinal fluid with little if any change in its physical appearance.

■ Histologically, the following changes have been observed in the fresh tissues examined by the writers:

Liver. — Parenchymatous degeneration, with evidence of central necrosis in many of the lobules. Fatty changes and cellular infiltrations in the portal spaces were found in most cases. Some of the sinusoids were flooded with leucocytes. Both bile and iron pigments were present. Inspissated bile was evident within many of the degenerated liver cells. Iron deposits present in the sinusoids had been phagocytized.

Kidney. — Parenchymatous degeneration with pale, swollen, and granular cytoplasm in the cells of the tubular epithelium. Many of the epithelial cells were separated from the basement membrane. The lumina of many tubules contained a homogeneous, eosin-staining substance, probably albumin. Congestion was most marked in the medullary portion of the organ. In those cases showing bloody urine, hemorrhages in the tubules and glomeruli were common. A few hyaline casts were found.

Spleen.—Varying degrees of congestion, with an unusually heavy deposition of hemosiderin were present.

Heart. — No microscopic abnormalities were found in the myocardium.

Brain and Cervical Spinal Cord.—There was nothing here discernible to account for the pronounced nervous symptoms observed clinically. All sections were essentially negative and no change even slightly suggestive of an infectious process was found. No changes were apparent in the myelin sheaths or the Nissl bodies.

to Infectious Equine Encephalomyelitis

By M. S. SHAHAN, L. T. GILTNER, C. L. DAVIS, and W. T. HUFFMAN,
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Occurrence

In many, though not all cases, affected horses have the history of having received antiserum, combinations of virus and serum, or vaccine from 30 to 90 days prior to appearance of symptoms of "X" disease. Most of Madsen's cases[1] had received prophylactic doses of encephalomyelitis antiserum. Marsh's cases[2, 3] for the most part received virus and serum or serum alone. Theiler[4] described cases following immunization procedures against South African horse-sickness. Slagsvold[5] reported cases following administration of antianthrax serum to horses. Findlay and MacCallum[6] recently briefly reviewed the literature concerning the disease, under the classification of hepatitis and jaundice incidental to immunization against certain virus diseases, including yellow fever of man. Their paper also noted that Gordon had encountered the disease following the use of antiwelchii serum in horses. These writers summarize the theories as to etiology as follows: "either (1) a hepatotoxic virus is introduced with the virus inoculum, or (2) two factors combine to induce the hepatitis (a) a hepatotoxic substance in the homologous sera or tissue extract injected and (b) an infective agent, which, in the case at least of human beings, is probably the causal agent of common infective hepatic jaundice."

In the United States, since Madsen's report of the disease in Utah horses, it has been reported to the Bureau from several states, always subsequent to an epizoötic of infectious equine encephalomyelitis and always confined to areas previously invaded by the latter. Unquestionably most, but certainly not all cases occurred amongst animals which had received antiencephalomyelitis serum. The disease was especially investigated in the field in Colorado by the Bureau in 1936. Here, as in previous or succeeding occurrences reported in Colorado, Iowa, Montana, Minnesota, South Dakota, Utah, and Wyoming, it made its appearance in from 30 to 90 days after the peak of the encephalomyelitis season. Some cases occurred in animals with no history of having received any biological product, and some few in animals recovered from frank encephalomyelitis.

Attempts to Produce the Disease

Repeated attempts have been made to demonstrate an infective agent in the tissues of horses dying of secondary disease. Marsh[7] and Newsom[8] have both made such attempts. In the course of the investigations in Colorado, mentioned above, samples of serum and oxalated whole blood were obtained from a clinical case of "X" disease and from six recovered animals, including one mule. In addition, liver, spleen, kidney, and brain tissues were obtained in buffered glycerin solution (pH 7.4) from an animal dead of the disease. Also a sample of commercially produced antiencephalomyelitis serum which

Following the 1936 outbreak of encephalomyelitis, veterinarians were somewhat startled by a report from Hadleigh Marsh of 89 cases of a highly fatal disease occurring in Montana in the same areas where encephalomyelitis had been prevalent six weeks previously. Of the animals affected, 81 had received encephalomyelitis antiserum. This article reports the results of investigations of this baffling malady, which continues to follow in the wake of encephalomyelitis. It clears up some, though by no means all, of the questions practitioners have been asking about it.

had been partially used in the field was obtained. Also, two samples of glycerinated brain from cases of "X" disease had been obtained from Colorado, and one specimen from a Montana case was received from Dr. Hadleigh Marsh.

These several specimens were injected intracranially and otherwise into guinea pigs without obtaining any evidence of the existence of an infectious agent. In all, nine horses, including an encephalomyelitis-immune animal, a swamp-fever carrier immune to encephalomyelitis, and a swamp-fever carrier not immune to encephalomyelitis, were injected in various ways with the several specimens. No abnormalities developed in any of the injected animals, although five of them later subjected to an intracerebral inoculation of encephalomyelitis virus developed typical encephalomyelitis. Thus no evidence that "secondary" disease is infectious was obtained. Among the diseases thus excluded was swamp fever, the lesions of which, in acute form, may somewhat resemble those seen in "X" disease.

The only microörganism of possible significance encountered in these field specimens was a streptococcus, which was later classified as *Str. fæcalis* and found to be non-pathogenic for guinea pigs. In the complement-fixation test, using this culture as an antigen against serum from a clinical or recovered case of "X" disease, there was no fixation of complement.[9]

Experiment with the Virus and Serum

The constant confinement of "X" disease to areas recently involved in outbreaks of sleeping sickness led the writers to investigate the possible relationship of encephalomyelitis virus, as well as encephalomyelitis antiserum, to it. It seemed possible, despite all contrary pathological and clinical evidence, that secondary disease might be a splanchnotropic manifestation of the normally predominantly neurotropic virus of equine encephalomyelitis. Accordingly, a group of horses and mules without history of previous exposure to encephalomyelitis, and from a source previously furnishing animals uniformly susceptible to western type virus, were given various combinations of virus and commercial antiencephalomyelitis serum. These injections and the results thereof are summarized in Table I.

It will be seen that the only symptoms which developed in any of the test animals were those of encephalomyelitis. As is usual with parencephalic injections of equine encephalomyelitis virus, only a portion of the animals injected developed frank enceph-

TABLE I. INOCULATIONS OF ENCEPHALOMYELITIS VIRUS AND ANTISERUM

Animal No.	Prev. history	Serum[1] before virus[2]	Virus[1]	Serum[1] after virus[1]	Results
H 806	E. M. imm.[2]	55cc 5-27-37	——	——	Remained normal[3]
M 991	S. F. car.[4]	55cc 5-27-37	——	——	"
H 1003	Nor.	55cc 5-27-37	10cc W. type virus 6-3-37[5]	——	"
M 1030	Nor.	55cc 5-27-37	"	——	"
H 1024	Nor.	——	"	55cc 6-5-37	E. M.[6] Killed 25 days
M 1031	Nor.	——	"	55cc 6-5-37	E. M. Dead 6 days
H 1023	Nor.	——	"	55cc 6-10-37	Remained normal
M 1032	Nor.	——	"	55cc 6-9-37	E. M. Dead 6 days
H 1028	Nor.	——	"	——	Remained normal
M 1033	Nor.	——	"	——	"

[1] Administered subcutaneously.
[2] Proved immune by intracerebral inoculation after the animal had been exposed to the bites of infected *Aëdes ægypti* and developed an occult infection with transitory virus in the blood.
[3] Daily observations and temperature recordings twice daily over a period of 4 months and subsequent casual observation for several months.
[4] Artificially infected with swamp fever 4-13-37; afebrile and quiescent at time of these tests.
[5] Ten percent saline suspension of guinea pig brain (western type virus-W).
[6] E. M.—frank encephalomyelitis with typical pathology and recovery of virus through guinea pigs (horse 1024 after inoculation of virus developed no symptoms until 23rd day).

"Secondary Disease" in Montana—*Photo by Marsh*

alomyelitis. The only unusual happening of the test was the exceptionally long incubating period (23 days) in the case of horse 1024, in which infection may have been delayed by the antiserum injected two days after the virus. The case was in every way typical of encephalomyelitis, aside from the long incubation period, and the presence of slightly more pathology in the liver than is usual for that disease. A freshly-prepared, bacteriologically sterile saline suspension of liver and spleen from horse 1024 produced nothing abnormal when 30cc was injected into a normal horse (1026), which was observed over a period of months.

Table II—Inoculations of Antiencephalomyelitis Serum

Animal No.	Previous history	100cc commercial anti-E.M. serum	Results
Horse 1003	E.M. serum, 5-27-37 W. type E.M. virus, 6-3-37	7-18-38	Remained normal through 90-day period
Mule 1030	E.M. serum, 5-27-37 W. type E.M. virus, 6-3-37	"	Fever lasting two days apparently due to local suppuration; otherwise normal through 90-day period
Mule 1033	W. type E.M. virus, 6-3-37	"	Remained normal through 90-day period
Mule 991	Swamp-fever carrier since 4-13-37 E.M. serum, 5-27-37	"	Remained normal through 90-day period except for periodic febrile reactions due to swamp fever
Mule 1019	W. type virus, 4-28-37 (recovered)	"	Remained normal through 90-day period
Horse 1023	W. type E.M. virus, 6-3-37	"	"
Horse 1028	W. type E.M. virus, 6-3-37	"	"
Horse 944	W. type E.M. virus, 4-22-37 (recovered)	"	"

■ In 1938, further attempts were made by the writers to produce "secondary" disease through the inoculation of serum. Table II summarizes work done at the Animal Disease Station, Beltsville, Md.

A Utah Experiment

During the 1938 season at the Salina (Utah) Experiment Station of the poisonous plants section of the Pathological Division an attempt was made to reproduce the so-called "secondary" or "X" disease of horses through the use of antiequine encephalomyelitis serum. Six horses were used in the experiment, one of which had been previously owned by the Station and brought there June 1, and the other five purchased in the Sevier Valley in the northern part of Sevier County and delivered at the Station July 14. Any of the horses may have been exposed to encephalomyelitis before arrival at the Station, since a few cases of the disease were reported from the Sevier Valley during the summers of 1937 and 1938. The Station is located approximately 16 miles from the valley at an elevation of nearly 8,000 feet, and it is doubtful that exposure could have occurred after their arrival there. All of the horses were fed alfalfa hay from July 25 to October 12.

On July 25 each of the horses was given 60cc of commercial antiequine encephalomyelitis serum subcutaneously and 21 days later, on August 15, two of them were given a second dose of the same amount.

Theiler's observations of a parenchymatous hepatitis in malziekte or "staggers" in South African horses, with a possible relationship to feeding on *Senecio latifolius* (ragwort) in conjunction with immunization against South African horse-sickness, suggested the feeding of Senecio to some of the test animals. Two of the four horses that had received single doses of serum were given daily feedings of *Senecio spartioides* from August 5 to September 13, at the rate of 0.125% of their body weights. Both animals died from typical Senecio poisoning soon after the feedings were discontinued. The total amount eaten, on a green plant basis, was 45 pounds, or 4.12% of the body weight in one case, and 47 pounds, or 4.775% of the body weight in the other, during the 40 days this plant was fed.

The two horses that received the two doses of serum, and one of those receiving the single dose remained normal throughout the experiment, as did control animals.

■ The remaining animal, No. 204, a nine-year-old saddle horse, weighing 1,150 pounds and in excellent condition, but of a rather nervous type, that had received a single dose of serum on July 25, showed no symptoms of an abnormal nature until September 18, 55 days after the serum was administered, when it was observed to be slightly less active than usual. The pulse rate was 40, and the respiration rate 18. The temperature was 100.3°F., which was slightly above the average for this animal as shown by the daily observations that had been made. While it could not be definitely determined that icterus was present, the visible mucous membranes did not appear quite normal. The horse was not eating normally, and it drank water more frequently than usual.

This condition continued with slight change for about two days, but by September 21 the icterus was plainly evident and, as the horse had been placed in a separate pen, it was possible to determine that only about one-fourth the normal amount of hay was being consumed, and that this consisted mostly of the coarser stems, indicating a depraved appetite. Defecation was infrequent, and the feces were dry and light-colored. There was no indication of throat paralysis; the horse drank considerable water without difficulty. The animal seemed drowsy and yawned frequently, resting first one leg and then another. There was a slight discharge from both nostrils and the upper lip appeared to be drawn slightly to the left. On September 22 the right eye showed considerable congestion with a little pus, and on September 25 the left eye showed a similar condition.

There was little change in the general condition on September 22 and 23, except that the icterus became more pronounced. On September 24 the appetite was much improved and the bowel movements practically normal. The icterus started to clear up and had about disappeared by the 28th, as had also the congestion of the eyes. The horse made a rapid and apparently complete recovery.

The morning temperatures from September 11 to 17, during the seven-day period preceding the first noticeable symptoms, ranged between 98.4°F. and 99.6°F., and averaged 99.1°F., while for the seven-day period following, it ranged between 99.6°F. and 100.3°F. and averaged 99.9°F., the average temperature for the latter period being 0.8° higher than that for the former.

While it is not possible to state the cause of the condition described, it was very similar to some of the milder cases of "X" disease that occurred during the latter part of the outbreak that followed the 1933 encephalomyelitis outbreak in Utah, where prophylactic serum was used.

Summary

A brief clinical, epizoötiological, and pathological description of the disease is given.

Attempts to produce the disease by inoculation of laboratory animals and horses with tissues from typical clinical or recovered cases were unsuccessful.

One of several normal horses injected with encephalomyelitis antiserum developed mild, but apparently typical, clinical evidence of the disease.

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Field Diagnosis of Trichomoniasis

The increasing occurrence, or perhaps the increasing recognition, of Trichomonas infection among cattle calls for a practical clarification of recent research. It presents a real field problem—not a clinical oddity—and needs now to be dealt with as such. This genital infection of cattle is comparatively new in the experience of most veterinarians, but is of prime importance in explaining the cause of some otherwise mysterious cases of abortion, sterility, and pyometra.

Clinical symptoms of infection are often obscure even though the results are outstanding. In the bull, there is most often no symptom nor lesion; while in the cow, characteristic manifestations are slight vaginal and uterine discharges, early abortion, recurrent estrum, or pyometra. The recurrence of estrum in apparently settled individuals in from two to four months following conception is indicative of trichomoniasis as it is the rule for *Trichomonas fœtus* to induce abortion within this period. Such early abortions frequently are not noticed by the herdsman who unknowingly aids continuance of this type of "sterility" by immediately rebreeding the infected individual without allowing her to remain open the three to four months necessary for the infection to clear itself; thus the vicious cycle is repeated and the cow is often falsely branded as sterile. The frequent symptom of so-called pyometra is, in reality, maceration of the fetus *in utero* without expulsion, resulting in the retention of a large quantity of thin, greyish, almost odorless fluid. Some cows repeatedly fail to conceive because of deep-seated Trichomonas infection; others carry on their normal physiological processes in spite of the presence of the organism.

Positive diagnosis is not easy, yet the most certain procedure now known is very simple. The diagnosis depends upon finding the flagellate organism by microscopic examination in smears from the vagina or prepuce, or in tongue scrapings from an aborted fetus or from a new born calf from a carrier cow. The equipment consists of a wire 14 to 18 inches long, on one end of which is twisted cotton to form a swab. This swab is placed in a medium-sized test tube containing 5 to 10cc of physiological saline solution, and a cotton plug is inserted in the top. The procedure is to swab deeply within the vagina, especially along its floor and on the cervix, or deeply within the prepuce; return the swab to its tube; and examine microscopically within a few hours.

The examination is made within one's own laboratory; the most satisfactory method is to place a drop of the solution upon a slide, cover with a glass slip and examine for movement with diminished light under low power. The characteristic movement of the flagellate, undulating, twisting, and rapid, is readily seen. Examine the entire drop as there may be only one protozoan present. It is advisable to make two or three slides from the same tube. The morphology is as follows: *Trichomonas fœtus* is round to oval-, spindle-, or pear-shaped; there are three anterior flagellæ, and one posterior, a continuation of the longitudinal undulating membrane found along the body of the parasite. It may be distinguished from the numerous epithelial cells of the vagina and bladder, as it is less than one-third their size, and moves actively.

The findings in a herd of 51 dairy animals examined recently by this method illustrate the uncertainty of diagnosis. Each animal was subjected to approximately five examinations over a period of one month. Three cows and one bull were found to be infected; the results of the several examinations of these positive cases are as follows:

Positive Cases

	Cow A	Cow B	Cow C	Bull
1st Examination	Neg.	Pos.	Neg.	Pos.
2nd Examination	Pos.	Pos.	Neg.	Neg.
3rd Examination	Neg.	Neg.	Neg.	Neg.
4th Examination	Neg.	Neg.	Pos.	Pos
5th Examination	Pos.	Pos.	Neg.	Pos.
6th Examination	Neg.	Neg.	Pos.	Pos

The negative findings on some of the examinations may have resulted from high

dilution of the material when only a few organisms were present or from the parasite's being present only in the uterus.

It is, therefore, important to remember that a negative finding is never positive evidence of noninfection. Many examinations of the same animal may be necessary before finding the parasite or drawing a reasonable conclusion of freedom from disease. The herd sire should be examined with particular care, as he is usually the reservoir and means of spread of the organism. While cows recover readily from trichomonas infection, the disease is incurable in the bull and such animals should be slaughtered when infection is demonstrated.

M. C. ALSON, K. S. C. '39.
Manhattan, Kans.

Sterility Due to Vaginal Fibroma

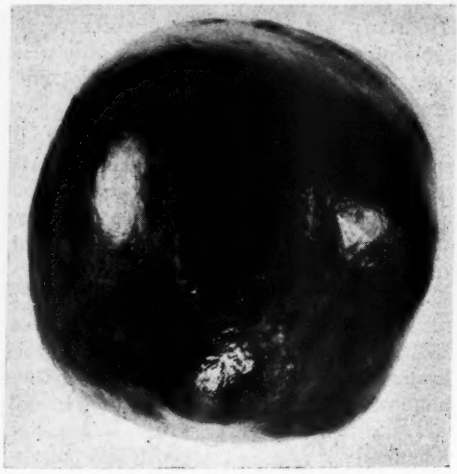
November 17, 1938, an eight-year-old, registered, Ayrshire cow was presented at the veterinary clinic of Kansas State College with the following history:

The cow calved November 2, 1937, retained the placenta. The attending veterinarian, while removing the placenta, called the owner's attention to the presence of a small growth in the vagina. Since that time the cow had not conceived, although her estrous cycle appeared normal, and she had accepted the bull numerous times.

Upon making manual genital examination for the cause of sterility a growth about the size of a small grapefruit was found attached to the floor of the vagina, directly posterior to, and occluding, the opening of the cervix. After consulting the owner, it was decided to remove the growth surgically the following day.

Technique of Removal.—10cc of a 1% solution of procaine was injected epidurally. The vulva was thoroughly cleansed with soap and water. A chain écraseur was introduced into the vagina, the chain being placed around the neck of the growth. After putting considerable pressure upon this instrument, it was found necessary to supplement its action by the use of an obstetrical wire saw. The growth was thus readily removed. Hemorrhage was controlled by placing large pieces of cotton saturated with dextrose over the cut surface of the vagina.

The cow was placed in a clean box stall with hay and water. After five days the vagina was examined and a clot of blood removed.



Fibroma four inches in diameter removed from the vagina of a cow.

There was no trace of fresh hemorrhage and repair had started. A douche of 2% chlorazene was given to flush out the vagina and remove the small fragments of clot. Upon examination three days later, the wound was in good condition with healing well under way. The cow was sent home.

Microscopical examination of the growth revealed it to be a fibroma (see illustration). It was circular in shape and measured four inches in diameter.

Since leaving the hospital the cow has accepted the bull and has passed several estrual periods; it appears that conception has occurred.

EUGENE F. DAMER, K. S. C. '39
Manhattan, Kans.

Strangles in Hogs

I have a swine problem that I have been unable to solve to my satisfaction. The hogs in question develop a parotitis, or at least

Strangles in a pig, showing the swollen jowl.—*Photo by Newsom*

abscesses in the region of the throat. Several of the cases have been successfully treated by lancing the abscess and swabbing the area with iodine.

Some of the swine have deeper abscesses than others. For instance, today I saw three mature sows about due to farrow, and each of them had a large swelling on one side of the jowl, extending upward almost to the ear. While these abscesses are forming and after they have developed, the affected animals become visibly sick. The temperature runs about 102°F., and there is difficulty in breathing because of the pressure caused by the abscess.

I cannot understand why there are so many hogs affected on this one farm. One sees an occasional case in general practice, but in my experience I have never before encountered anything just like this. Any information you can give will be much appreciated.—*G. E. B.*, Mo.

Comment.—This condition, or one very like it, is described by Hutyra and Marek as strangles in hogs, and a similar outbreak was described by I. E. Newsom in VETERINARY MEDICINE in 1937 (*Vet. Med.* 32:3, p. 137). So far as I have been able to ascertain, these are the only cases reported in the literature. Laboratory tests in the case reported by Newsom, and in some other unreported cases, have demonstrated streptococci, but the exact etiology is still unknown. Drainage and antisepsis comprise the only treatment which has been suggested. It appears that an autogenous bacterin might be of value.

Further discussion of this condition by readers of VETERINARY MEDICINE who have treated cases is invited.—*A. T. K.*

Cesarean Section in a Sow

The patient was a primiparous sow, weighing about 175 pounds. Prior to parturition the animal had been active and in good health. Eight mammary divisions were fully developed and secreting milk. When I was called on the case the owner reported that the sow had been showing signs of labor for two days, straining uneasily and exhibiting strong labor pains, but had made no headway in delivery.

The animal by this time was irritable and resentful of strangers; it was therefore restrained for digital examination by placing a slip noose of ¾-inch rope in the mouth, drawing it tight around the upper jaw, and securing it to a post in the corner of the pen.

Examination disclosed a rigid os with no dilation and a torsion of the uterus. When the condition was explained to the owner, he consented to a cesarean operation, and the animal was placed in a hog rack and brought to my hospital.

Before the sow was removed from the crate the hair on the right flank was clipped close. Then ten-foot ropes were tied around each foot above the ankle joint and the animal was allowed to back out of the crate. With the ropes in place, it was easy for two men to cast the sow onto its left side, tie it securely, and hold it for anesthetizing.

Two ether bags (made from clean, white grain sacks) were wrapped around the snout and tied in place just below the eyes with a piece of stout twine. Ether was poured onto the bags just at the tip of the nose, and in a few minutes the animal was completely anesthetized without undue struggling.

The sow, still lying on the left side, was then slipped onto a cleated rack and lifted to the operating table. The legs were stretched front and back and secured by tying with the ropes previously placed on them. The clipped area over the right flank was washed thoroughly with soap and water, dried, and doused with 70% rubbing alcohol. An operating sheet soaked in a 5% septico solution was draped over the patient, with a slit through the cloth at the point of operation.

A seven-inch incision through the skin and underlying tissues parallel to the last rib and posterior to it, exposed the right horn of the uterus, and manual exploration disclosed one live pig in this horn. Part of the horn was drawn outside the incision, and towels soaked in warm antiseptic solution were placed between the womb and the edges of the incision to prevent drainage into the abdominal cavity. A transverse incision was made just posterior to the bifurcation into the right horn, and the fetus removed. Further examination made by passing the hand and arm through the incision to the end of each horn showed this to be the only fetus present, and disclosed a complete torsion of the uterus to the right, which was corrected.

The incision into the horn of the uterus was closed by a continuous, lock-stitch suture, using No. 000 dry catgut which had been soaked in alcohol for 15 minutes. The suture was started at the upper commissure of the incision and anchored by a square knot, with a two-inch end left free for the final tie. The stitches, one-quarter inch apart, were continued the length of the incision; at the lower commissure the catgut was doubled before inserting the last stitch, so that another square knot could be tied as a second anchor. A second row of stitches was then put in, starting at the lower commissure, each stitch being started far enough back on the outer layer of the wall of the horn to bury completely the first layer of stitches. The two-inch end of catgut left at the beginning of the suture was used to tie the final stitch.

The horn and incision were then bathed in warm, antiseptic solution, removing all blood and fetal discharge, the towel packs were removed, and the exposed portion of horn was returned to the interior of the abdominal cavity and adjusted to its normal position.

The outside incision was closed with interrupted sutures of No. 12 braided silk. This was done by inserting the needle through the skin on the right side of the incision, continuing through all the tissue layers into the abdominal cavity, and then reversing the process, coming out through the skin on the left side of the incision. The stitches were placed about one-half inch apart, and all were placed before any were tied. All blood was removed from the edges of the wound before closing; then each stitch was drawn together and tied with a square knot, with sufficient tension so that when the tying was completed the edges of the incision were in perfect apposition.

A large-sized spaying needle was used to do the suturing.

Five days later healing by first intention was complete, and the stitches were removed from the skin incision.

By an accident the little pig died from exposure the first night, and for four days the sow's teats were full and tender, but not caked. No attempt was made to relieve them by drawing the milk, and by the sixth day the swelling and soreness had disappeared.

In my experience, ether has proved to be a very satisfactory anesthetic for swine, being easily administered with no apparent ill effects on the subject. In this case, a little over one-half pound was used. One-half hour after being removed from the operating table, the patient had regained consciousness and was able to move about

on its feet. The morning after the operation it drank a little milk and water, and on the next day grain was added to make a thin slop. The kidneys functioned normally from the first; the first bowel movement, which took place on the third day, was normal in amount and texture.

On the seventh day the sow left the hospital as active as ever.

C. M. MERRILL

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Swine Erysipelas

Further information is desired relative to a condition recently observed in a litter of seven, 60-pound Hampshire shotes. There

Swelling of the joints was a pronounced symptom in this case of swine erysipelas

was no other breeding swine on the premises. The sow and pigs were kept in a rather filthy pen and sheds.

In the beginning, according to the owner, the pigs manifested locomotory disturbances. They were unthrifty, and their joints were quite sensitive and slightly swollen, some of them noticeably so. The sow was apparently normal; it had, however, been obtained from a farm on which swine erysipelas had occurred the year before. The owner, realizing that the pigs were a liability, readily consented to an autopsy, and three of them were destroyed and autopsies performed.

The lesions varied, apaprently with the intensity and chronicity of the process. In some cases there was a mild inflammation of the synovial membrane with infiltration and tumefaction of the perisynovial structures. In the beginning, it looked as though the synovial membranes had been congested and as the disease progressed varying quantities of fluid accumulated in the joint cavity. The accumulated fluid was in some instances turbid, and in others it contained coagulated or flaky material. In the later stages of the more chronic cases, there was an apparent thickening of the synovial membranes due to fibrous proliferation. The fibrous formation may have

Swine Erysipelas

involved the perisynovial structures and become sufficiently dense to render the joints immobile.

Comment.—The history, symptoms, and lesions given are quite suggestive of swine erysipelas. Various types of arthritis have been described, but the identification of specific infection such as erysipelas probably eliminates group conditions that were formerly described as polyarthritis. Destruction of these pigs was good practice, since there is no known remedy for chronic swine erysipelas.

A lethal factor causing hydrocephalus, light coat color, and short tail, appeared in the progeny of one Duroc-Jersey boar when mated with some of its daughters and of its son mated to its dam and its daughters. In the litters in which hydrocephalus pigs appeared, there were 136 normal, and 22 male and 20 female hydrocephalus pigs. The condition seemed to be controlled by a single recessive gene designated as h. There was no evidence of sex linkage. Three color variations suggested the possibility that the syndrome was due to closely linked genes instead of to three effects from one gene.—*Exp. Sta. Rec.*, Vol. 80, No. 2.

Differentiation of Canine Hematozoa*

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DUE probably to the rather striking pictures presented by Dirofilaria infection, both in post-mortem findings (fig. 1) and in the microscopical examination of fresh blood, the interest of the profession in this condition recently has been considerably stimulated.

Although Lewis,[1] more than fifty years ago, made a series of very pertinent observations on nematode larvæ in peripheral canine blood, and Mönnig[2] lists six microfilariæ which have been so reported, the recognition of lashing, wriggling parasites in fresh blood preparations is accepted quite generally as justifying a diagnosis of heart worm or *Dirofilaria immitis* infection.

■ According to Neumann[3], nematode hematozoa are found more frequently in the dog than in other domestic animals. In 1890 they were considered as belonging to four distinct species: the hematozoa of Lewis, *Filaria immitis* (Leidy), *Strongylus vasorum,* and *Spiroptera sanguinolenta.*

Hematozoa of Lewis.—This was the name given a class of embryonic nematodes first observed by Gruby and Delafond and later by Manson, Lewis, Sonsino and Grassi.[3] These larvæ were found to be 280 μ long and 5 μ wide, the cephalic end being slightly attenuated and the caudal extremity terminating in a very fine tail. The hematozoa show a rudimentary alimentary canal and resemble very closely the larvæ of *D. immitis.* They were thought to differ from *D. immitis* larvæ in that they attached themselves to the cover glass by their buccal extremities. This phenomenon was observed and described by Mundhenk, Howell, and Greene[4] as being present in larvæ which, up to the present time, have been considered to be *Microfilaria immitis.* The adult form of this parasite was never found by investigators of the 19th century.

Filaria immitis.—This parasite, now designated *Dirofilaria immitis,* was first reported in the blood of dogs by Panthot in 1679, and later by La Peyronnie in 1778[3]. Peysson, of Montpellier, France, reported the finding of an adult heart worm in 1806.[3] It was later reported by I. C. Osborne, of Erie, Alabama, and in 1850 Gruby and Delafond[3] found what they called *Filaria papillosa hematica canis cordis* in the heart of a dog. Leidy, in 1856, designated the parasite as *Filaria immitis.* In 1858 Schuppert[5], of New Orleans, published results of his study of *D. immitis.*

Baughton, Byrd, and Lund[6] attempted to reverse the ordinary periodicity by changing the habits of the definitive host. They noted sharp rises in the total number of parasites per cubic centimeter of blood during rest periods, and sharp drops during activity periods. Their conclusion was that periodicity is determined by current host activity as well as by antecedent host behavior.

Underwood and Wright, in 1933, reported the numbers of microfilariæ of *D. immitis* present at different times during a 24-hour period in measured volumes of peripheral blood of two dogs. In 1934, Hinman performed similar work, using 14 dogs, and Inoue, in 1935, used four dogs. The available data indicate that the peripheral circulation is never entirely free of larvæ, although but few are present between 8 a. m. and noon, while the maximum number occurs between 10 p. m. and 2 a. m.

Faust,[5] of Tulane, found the low point of the periodicity curve to vary from 8 a. m. to 6 p. m., although it was most frequently reached at noon (33.3% of the observations). The peak was reached most often at midnight (50% of the observations), although in 33.3% of the counts it was attained at 2 a. m. and in 16.6% as late as 4 a. m. The interval between the lowest

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Fig. 1

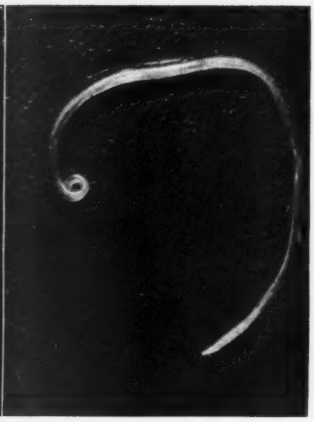

Fig. 2

Fig. 1. Canine heart opened to show mass of *D. immitis* in right portion. X 1/3.
Fig. 2. Adult *S. sanguinolenta*. X 3.

and highest count varied from eight to 16 hours.

Blackberg and Ashman[7] conducted experiments to determine the nature of circulatory embarrassment and subsequent cause of death from heart worm infections. Electrocardiograms suggested that anemia of the cardiac muscle might be taken as the chief cause of the fatigue often observed in infected dogs after moderate exercise.

Fig. 3

Fig. 4

Fig. 3. Luminal opening of canine esophageal cyst—*S. sanguinolenta*. X 3.
Fig. 4. Exterior of canine aortic cyst—*S. sanguinolenta*. X 3.

Spiroptera sanguinolenta.—Neumann pointed out that this genus, now called *Spirocerca sanguinolenta,* was first found in tumors of the aortic walls, by Morgagni and Courten in 1760.[3] It was seen on two occasions by Megnin and Chauvrat, who called it *Spiroptera sanguinolenta.*[3] However, Lewis, of Calcutta, India; Manson[8], of Amoy, China; and Silva Aranjo, in Brazil, frequently observed it. These aortic tumors vary from 5mm to 30mm in diameter and may occur singly or in numbers of two or three, which are sometimes connected by fistulous tracts. Megnin, Chauvrat, Perroncita, and Caprini have witnessed dogs dying suddenly from hemorrhage due to rupture of the walls of the aorta.[3] The worm (fig. 2) sometimes burrows along just beneath the intima, leaving one of its extremities floating free in the lumen (fig. 3). Lewis has found in some instances the lumen of the aorta to be nearly obliterated by a clot formed about the parasites. *S. sanguinolenta* also has been found in the lymphatics, particularly those in the vicinity of the esophagus. This parasite has been reported more often in the esophagus than in the aorta (fig. 4). According to Manson, its presence in the esophagus is manifested by frequent vomiting and coughing, sometimes resulting in death as a consequence of rupture.

Grassi, in 1888, published the results of his work on the evolutive cycle of *S. sanguinolenta.*[3] He claimed that the intermediate host was the Eastern cockroach (*Periplaneta orientalis*), one of the insects known in France as the American cockroach (carfard and cancrelat). He found large cysts in the abdominal cavity of this insect, which contained young nematodes resembling the larval form of *S. sanguinolenta.* These cysts were fed to dogs and young spiropteres were found embedded in the esophageal mucous membrane, when

autopsies were performed on them 15 days later. From this experiment he concluded that the cockroach, feeding on the excrement of dogs infected with *S. sanguinolenta*, ingests the larvæ, and that other dogs, in turn, are infected by eating these parasite-bearing insects. In view of the fact that it has been the investigators' experience that dogs chase and kill, but never actually eat, cockroaches, and that this has been borne out by many dog owners and kennel operators, there is some doubt as to the accuracy of this generally accepted theory of transmission.

■ Although exceedingly common in some parts of the world, particularly in the Orient, heart worm infection in the United States was considered, until recently, to be more or less restricted to the Gulf and South Atlantic coasts; but lately it has been reported from practically all parts of the country.

In view of this reported spread, the writers undertook the examination of 100 dogs used in this institution as anatomical subjects, mostly animals obtained from the pounds of Columbus, Ga., and Montgomery, Ala. Of the cadavers examined, 73% showed the presence of either esophageal or aortic cysts containing *S. sanguinolenta,* or the esophageal worm, without a single specimen being positive for heart worm. Blood examinations of these dogs were not made.

Forty-nine animals were next obtained from the same sources and one from Savannah, Ga. Before destruction and autopsy their fresh blood was subjected to careful examinations, with positive findings of apparently identical hematozoa in 40 of the 50 dogs.

Of the 40 animals positive for hematozoa, autopsy revealed one pair of adult *D. immitis* in the right ventricle of the animal from Savannah, 34 cases of esophageal or aortic cysts containing *S. sanguinolenta* and five in which no parasites other than hookworms could be found. The 10 animals negative for hematozoa on blood examination showed no endoparasites other than various intestinal worms.

BIOLOGICAL CLASSIFICATION AND RELATIONSHIP OF *D. immitis* and *S. sanguinolenta*

METAZOA
HELMINTHES
Phylum Nemathelminthes
Class Nematoda
Order Filarioidea
Family Spiruridæ
Subfamily Arduenninæ
Genus Spirocerca
Species sanguinolenta
Family Filariidæ
Subfamily Filariinæ
Genus Dirofilaria
Species immitis

■ In attempting morphological differentiation of the hematozoa it became necessary to modify the technique of Morris, Dinkle and Green[9] as follows, in order to obtain permanent dry preparations.

From 10 to 20cc of blood was withdrawn from the recurrent tarsal vein by means of a Luer syringe, allowed to clot in a Petri dish, and the dish tilted to effect separation of the serum. The serum, preferably untinged by erythrocytes, was pipetted off, mixed with an equal amount of 2% acetic acid, and centrifuged five minutes at moderate speed. The supernatant serum was pipetted off and discarded, an amount of normal salt solution equal to the discarded serum was added, mixed with the sediment by shaking, and the mixture recentrifuged. This supernatant liquid also was discarded and several loopsful of the sediment spread on slides previously treated lightly with Mayer's albumin fixative as in the mounting of paraffin sections.

The slides were dried at room temperature, as even moderate heat shrinks the parasites, fixed by flaming off a few drops of absolute methyl alcohol and immediately stained by immersion in dilute Giemsa stain (one drop to one cubic centimeter) for from one to three minutes. The preparations were then rinsed lightly by immersion, redried at room temperature, and at once mounted in xylol-dammar, using a No. 1 cover glass. By this method the shrinkage of the parasites is held at a minimum, measurements of hematozoa so prepared checking identically with those of freshly-killed larvæ examined in wet preparations. In case undue shrinkage

should occur in an overdried mount, it is recognizable by the presence of a clear zone immediately surrounding the fixed parasites, since the albumin film also takes the stain lightly.

Upon comparison of stained specimens from animals which, on autopsy, showed *S. sanguinolenta* in either esophageal or aortic cysts, and from others showing adult *D. immitis* in the right heart or pulmonary arteries, the following differences were noted:

	Specimens positive for *S. sanguinolenta*	Specimens positive for *D. immitis*
Minimum length	219.60 Microns	224.48 Microns
Average length	233.63	235.58
Maximum length	244.00	256.20
Minimum width	3.00	4.50
Average width	3.25	4.75
Maximum width	3.50	5.00
Minimum cephalic width	4.00	3.50
Average cephalic width	4.25	3.75
Maximum cephalic width	4.50	4.00
Minimum distance from cephalic extremity to first somatic cell nucleus	9.00	5.00
Average "	9.75	6.80
Maximum "	11.00	8.00

Thus, while these two hematozoa are of almost the same length and practically identical in appearance when observed unstained and in motion, examination of fixed, stained specimens reveals outstanding differences, as might be expected of parasites of such zoölogical relationship. The esophageal worm larva has a slightly narrower body, but a wider cephalic extremity free of somatic cells for a distance of approximately 10 μ, while the heart worm larva has a wider body and a narrower and rather tapering cephalic extremity free of somatic cells for a distance averaging less than 7 μ (fig. 5).

These measurements have been found much more practical for the practitioner than the complicated series of measurements based on the determination, in terms of total body length percentage, of the relative locations of almost unrecognizable anatomical features.

The esophageal worm larva also bears definite cephalic features, including a protrusible, apparently tubular proboscis, a series of dot-like markings arranged in two rows, and a movable dorsal spine or crest not yet demonstrated in the heart worm larva. The latter also exhibits a greater affinity for Giemsa and other stains than the esophageal worm larva, requiring approximately but one-third the staining time.

Before reaching our present conclusions on the possibility of demonstrating two parasitisms where but one had previously been shown, we erroneously reported the above and certain other morphological observations as applying to the larva of *D. immitis*, a statement which we now correct by substituting *"S. sanguinolenta."*

The technique necessary for the making of these observations, while more complicated than that used in the mere determination of the presence of hematozoa, is not laborious but entirely within the scope of the practitioner with average equipment. Microscopical differentiation, after preparation of the stained slides, requires but a few minutes, and may be accomplished by the use of a 10x ocular with a 43x, "high-dry" objective, the combination giving a magnification of 430 diameters. Naturally, an oil immersion objective, giving a magnification of about 970 diameters, is preferable.

■ Should these findings be later corroborated by other investigators, we believe that they should surround with considerable doubt the authenticity of accepted ideas on the life cycle of the esophageal worm. This parasite is ovoviparous, while

The futility of administering a protracted and expensive treatment for heartworm to a dog free from this parasite but harboring the esophageal worm is obvious. Giving a favorable prognosis where an aortic aneurysm is a probability is likely to prove embarrassing. Hence the imperative need of differentiating between *D. immitis* and *S. sanguinolenta*.

the heart worm is viviparous. The adult female esophageal worm may be seen to contain innumerable ova, those nearer the point of exit containing embryos almost ready to rupture their shells (fig. 6).

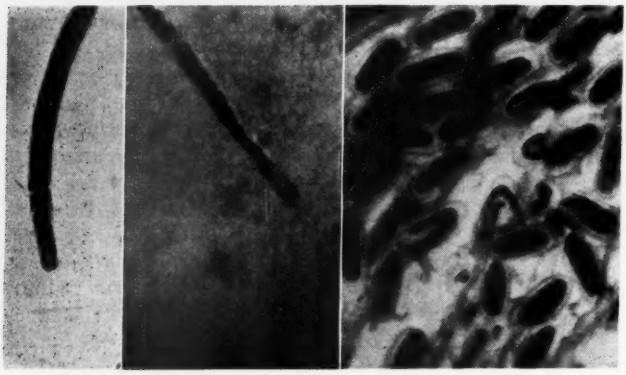

Fig. 5 Fig. 5a Fig. 6

Fig. 5. Cephalic extremity of larva of *D. immitis*. Giemsa stain. X 750.
Fig. 5a. Cephalic extremity of larva of *S. sanguinolenta*. Giemsa stain X 750.
Fig. 6. Embryonating ova in uterus of *S. sanguinolenta*. H. & E. stain. X 750.

An especially interesting and doubtful point in the life cycle of this parasite is the method by which the larva gains entrance to the blood stream. On this subject we can only say that females in both aortic and esophageal cysts have been observed to contain ova, but that no ova have been found in the cysts outside the body of the adult. As the cysts generally communicate with the lumen of the aorta or esophagus; and as the ova, so far as we know, have not been observed, in any number, in the feces, it would appear logical that the ovum from an aortic cyst passes directly into the blood stream and there develops into a larva, while the ovum from an esophageal cyst enters the lumen of that tube, passes through the highly acid stomach protected by its shell, develops into a larva in the upper small intestine, and migrates thence to the blood stream, either directly or *via* lymph vessels. We place the probable point of embryonation of ova from esophageal cysts in the upper small intestine, rather than in the stomach, because of our findings that the larva is almost instantly killed, *in vitro*, by 1% acetic acid and that, therefore, after embryonation, it probably would not be able to pass successfully the heavy hydrochloric acid concentration of the canine stomach.

Another plausible assumption would be that the ovum embryonates in the cyst, and that the larva makes its way into the blood stream directly or indirectly from that point. This possibility, however, is somewhat contraindicated by inability to demonstrate shell fragments in the cyst capsules.

Whether (and, if so, how) the larva gets from the blood stream to the outside world and gains entrance into the supposed intermediate hosts, the roach and other dung-eating beetles, are problems requiring individual investigations, but recognition of the larva as an inhabitant of the blood stream in one phase of its existence would appear to render doubtful present theories of the parasite's life cycle and of the identity of the secondary host.

Our observations on the ovum in general coincide with those of Faust[5], although we have not attempted to corroborate his findings on the morphology of the first stage larva. No larvæ of this stage have been observed, and no incubation experiments have been carried out by us.

■ The possibility and even probability of double infection naturally must not be overlooked, although we have not found an animal showing both parasites, nor an animal showing the *S. sanguinolenta* in both esophageal and aortic cysts.

The occurrence of these cases within 200 or 300 miles of the South Atlantic and Gulf Coasts, the heaviest heart worm-infected areas of the United States, together with the similarity of the hematozoa when examined in fresh blood specimens, point to the probability that, at least in certain sections, a rather high percent-

age of cases now diagnosed and treated as heart worm infections, are actually instances of esophageal worms. That this might seriously confuse the practitioner who treats such patients with one of the commonly used heart worm specifics, is evidenced by a recent clinical case.

A large, male pointer, apparently four or five years old, was presented in an extremely emaciated and semi-comatose condition. On microscopical examination of a fresh specimen, its blood was found to be teeming with larvæ. Under dietary and rest treatment it regained considerable flesh and strength, and one of the proprietary compounds was administered carefully, but finally pushed to the point of severe antimony poisoning. Examinations averaging three per week over a period of a year and a half never failed, in a single instance, regardless of the time of the day or night, to show numerous hematozoa. This animal was destroyed recently and found negative for heart worms, but showed three large esophageal cysts filled with living *S. sanguinolenta*. All other findings were negative.

The finding of hematozoa, at various times of the day and night, in the blood streams of this and many other similarly affected animals, tends to indicate that the periodicity reported for the heart worm does not exist in esophageal worm infection.

■ The results of serological diagnoses of hydatid or echinococcus infection of human beings having been so gratifying, it appeared possible that a similar technique might be useful in diagnosing and differentiating these two parasitisms. Tables showing results of this investigation are appended.

The antigen was prepared by comminuting the washed parasites in a mortar. This material was then extracted with 95% ethyl alcohol, acetone, ether, alcohol-glycerin, or glycerin. Still another extract was made by macerating the comminuted material with isotonic aqueous sodium chloride solution. In each case, five cubic centimeters of fluid was used to extract the anaphylactic material of adult parasites of both species. Each solution was then filtered through a Jenkins "D" filter with an "F" block. Chloroform, in a concentration of 0.5%, was added to the saline extract as a preservative. Since the saline extract produced the most pronounced wheals on intradermal injection, it was used almost exclusively in these experiments. Each animal was injected in the sensitive abdominal skin with antigenic solutions of each parasite. Reactions became evident in from 30 minutes to four hours. From the results shown in the tables, it is apparent that intradermal tests by this technique are not reliable.

TABLE I. ANIMALS TESTED WITH EXTRACTS OF S. SANGUINOLENTA AND D. IMMITIS

Dog	M-B exam.*	Intradermal tests *S.s.*	*D. i.*	Post-mortem findings
1.	Neg.	Neg.	Neg.	Neg.
2.	Neg.	Neg.	Neg.	Neg.
3.	Neg.	Neg.	Neg.	Neg.
4.	Neg.	Neg.	Neg.	Neg.
5.	Neg.	Neg.	Neg.	Neg.
6.	Pos.	Pos.	Neg.	Adult *S. s.* Esoph. Cysts.
7.	Pos.	Pos.	Neg.	Adult *S. s.* Esoph. Cysts
8.	Pos.	Pos.	Pos.	Adult *D. i.* r. ventricle.
9.	Pos.	Neg.	Neg.	Hookworms in intestine.
10.	Pos.	Neg.	Neg.	Severe hookworm infection.
11.	Pos.	Neg.	Neg.	Severe hookworm infection.
12.	Pos.	Neg.	Neg.	Severe hookworm infection.
13.	Pos.	Pos.	Neg.	Enlarged lymphatics. Hookworms in intestine. Empty sac in aorta.
14.	Pos.	Pos.	Neg.	Adult *S. s.* Esoph. Cysts
15.	Pos.	No test	No test	Died from aortic aneurysm containing *S. sanguinol.*

*Microscopic examination of the blood for larvae.

TABLE II. RESULTS OF PRECIPITIN TESTS, EMPLOYING RABBIT SERUM.

Rabbit	1:1	1:100	1:1000	1:10000	1:50000	Control	Cross
1*	+++	+++	++	—	—	—	—
2**	++++	+++	++	+	—	—	—

*Immunized with *S. sanguinolenta* extract.
**Immunized with *A. caninum* extract.

In order to test further the parasitic antigens for immunological specificity, precipitin experiments next were carried out. The antigens were prepared by dissolving the precipitated material of the alcoholic extracts in isotonic aqueous sodium chloride solution. This material was injected intravenously into adult female rabbits. The initial 8cc injection was followed by four injections of 4cc each, at five-day intervals. Five days after the last injection, following a period of starvation to preclude the possibility of cloudy serum, blood was withdrawn from the left heart. This serum was titrated in seven dilutions as indicated in the tables.

The findings of the precipitin tests are particularly interesting because of the

negative results in attempted cross agglutinations; precipitins prepared in this manner appear to be fairly specific for these closely related parasites.

TABLE III. RESULTS OF PRECIPITIN TESTS, EMPLOYING CANINE SERUM.

Dog	1:1	1:100	1:1000	1:10000	Control	Cross
1*	++	+	—	—	—	—
2**	++	+	—	—	—	—

*Known to be infected with *S. sanguinolenta*.
**Known to be infected with *D. immitis*.

It would, therefore, appear that the precipitation test may be made practicable in some instances but that the close biological relationship of the two parasites makes it extremely difficult to isolate a highly specific anaphylactogen. A further probable disadvantage of the precipitin and intradermal test methods is the fact that recovered animals might react positively, leading to unnecessary treatment.

■ Another confusing aspect of the problem is that, in five of the fifty experimental animals examined ante and post mortem, we were unable to demonstrate either of the adult parasites, although the blood contained numerous hematozoa apparently identical with the others, so far as the examination of fresh blood specimens was concerned. As these cases unfortunately were encountered early in our investigations, before the staining technique was developed, we are unable to report on the detailed morphology of the hematozoa present in these instances. An interesting and possibly pertinent point is that the five animals under discussion were very heavily infected with hook worms. While this may or may not be indicative, it opens a field of investigation into which we hope to continue later.

■ Regarding the clinical aspects of the subject, particularly as to means of prevention and treatment, we prefer to remain silent except for a brief résumé of the symptomatology. The symptoms of the early stages of both conditions appear slight, and, even in more advanced cases, no pathognomonic evidences of infection are known to exist. Early tiring and general unthriftiness in working dogs appear to be the first trouble signs in heart worm infection, and similar unthriftiness, often with cough and vomiting, in *S. sanguinolenta* infection.

A remarkable feature of the relationship of these two parasitisms is that the symptoms mentioned in the literature for one may as rationally be ascribed to the other. However, vomiting and coughing are more often the result of esophageal involvement than of endocarditis, although the early tiring of working animals might be expected in either infection. In fact, these and other symptoms occur in so many conditions as to be practically valueless as means to an exact diagnosis. The most common final stages of heart worm infection appear to be emaciation and cachexia, although many animals undoubtedly harbor for years a limited number of adult parasites and finally die of other and unassociated causes. Probably the most severe of the final stages of esophageal worm infection is the dissecting aortic aneurysm, not an uncommon termination in this condition.

■ It is with regret that we present these findings without being able to suggest a satisfactory preventive or treatment for the latter parasitism, which we believe, by the methods outlined, to be definitely differentiable from heart worm infection. However, the futility of administering a protracted, expensive and resultless course of treatment to an animal free of the parasite for which the treatment is specific, but harboring the esophageal worm, is obvious, and making an encouraging prognosis in the case of an animal in which a verminous aortic aneurysm is an ultimate possibility, is an embarrassment to be avoided if possible. These findings are made public in the hope that investigators in various sections may be able to check our observations, and, in case of their corroboration, that satisfactory preventive and remedial methods may be developed.

Acknowledgments

The investigations upon which this report is based were, in part, participated in by Dr. W. M. Howell, as well as by the

writers. Dr. Howell was seriously injured in an automobile accident some months ago and has been unable to be present in our later work. Our particular thanks are due to Drs. G. T. Turnipseed of Columbus, Ga., and E. A. Case of Savannah, Ga., for their kindness in supplying us with animals.

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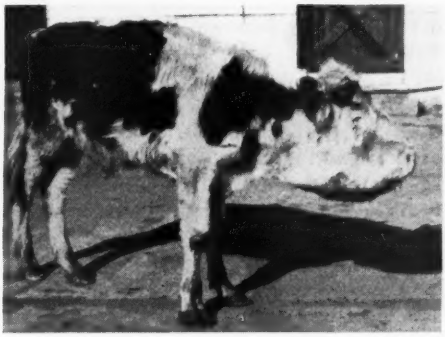
Actinomycosis in a Steer

January 29, 1939, a yearling Hereford steer was presented to the veterinary clinic of Kansas State College with a history of having had a swollen lower jaw since it came off pasture, and that the jaw had gradually become larger until it was enormous in size (see illustration).

The patient was greatly emaciated and showed a severe dyspnea due to the excess swelling. The temperature was 102.4° F., pulse 45, and respirations 21. The mucous membranes were pale and a blood count revealed anemia. Examination of the jaw revealed no localized actinomycotic abscess, and no abscess developed until the ninth day when a small abscess in the intermaxillary space was incised and enough purulent material obtained to verify the diagnosis.



The illustration does not show the width of the face, which was at least twice normal.

A diagnosis of actinomycosis of the bone, caused by *Actinomyces bovis,* and actinobacillosis of the soft tissues, caused by *Actinobacillus lignieresi,* was confirmed by a microscopic examination of the pus from the small abscess. The prognosis was guarded.

On the first day of hospitalization, and every day thereafter during its stay in the hospital, the patient was given, per os, one ounce of orgadine, an organic iodine compound. On the first, fifth, and 11th day, one ounce of sodium iodide in one pint of distilled water was administered intravenously. Little improvement was observed until about the sixth day, when the dyspnea was somewhat relieved, the patient began to eat a little and chew its cud.

Improvement continued and the patient was released from the hospital after 13 days with only a slight swelling of the lower jaw which was gradually receding to normal. The general condition was decidedly improved; the temperature was 102° F., the pulse 60, and respirations 12 per minute.

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Fright Disease an Avitaminosis

By JOHN W. PATTON, East Lansing, Mich.

FRIGHT disease, then more commonly called running fits, first began to be reported from the southern states in 1916; by 1920 reports of its occurrence were coming from widely separated localities in the northern states and Canada; two years later it was prevalent all over America. In 1924 it was first reported from England, where it was and still is termed canine hysteria. It soon became common there and has continued prevalent.

No statistics are available as to the number of cases that have occurred. Most veterinarians reporting it speak of seeing "a great many cases."[1] One veterinarian[2] in 1923 reported treating up to 50 or 60 cases a month. It has not been reported as occurring in waves in any given locality,[3] as most infectious diseases occur, but in a well maintained level of prevalence.

Usually the mortality is low. A common sequel is destruction of the dog because of recurrent attacks.[4] This wholly unnecessary loss probably exceeds the mortality due primarily to the disease. Another common sequel is complications from which the animals die. One veterinarian states that distemper follows attacks of fright disease in 80% of his cases. Another claims of 800 consecutive cases all were distemper.[5] Others report that this outcome is frequent. Others report that a significant number of those attacked ultimately succumb to the ingestion of foreign bodies. In other cases the dogs receive mortal injuries or are lost during attacks of running fits and are never seen again by their owners. Beyond question, fright disease is one of the ailments of major importance to dogdom in this country at this time.[6]

The etiology of fright disease has been the subject of endless discussion.[7] Infection,[8] specific infection,[9] diet, indigestion, various deficiencies, alimentary toxemias, intestinal parasites, hormone imbalance, allergy, circulatory disturbances, environment, sundry irritations and excitements, discipline, excessive loss of heat, anal abscesses,[10] in-and-in breeding, heredity, estrus,[11] avitaminosis A[12]—all have had their advocates as the cause, or at least a cause, of this ailment, but probably a greater number have attributed it to an improper diet than to any other one cause.

Treatment has run the gamut of about everything in the pharmacopeia, with sedatives and cathartics, in the order named, the most popular. A pecularity of the disease often noted is that a change of diet has practically always stopped the attacks, usually only temporarily. So many attacks have occurred in dogs fed on commercial dog biscuits that numerous observers have been convinced that they are the chief cause. On the other hand, cases have so regularly recovered when the animal was placed on a milk and meat diet[13] that this, where practical, has come to be the most popular dietic treatment.

■ For a number of years we have preached the gospel that many of our disease problems would be clarified only in the light of more complete understanding of the various nutritional requirements of animals.[14] In no case is this more evident than in so-called fright disease in dogs.

Our attention was first called to fright

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[14] Patton, J. W., 1932. A Study of Commercial Dog Foods. *Vet. Med.* 27:5, p. 204; ———, 1932, Further Studies on Commercial Dog Foods, *Vet. Med.* 27:11, p. 482; ———, 1934. Further Studies of Commercial Dog Foods. *Vet. Med.* 29:3, p. 138.

disease about two decades ago, and in the interim we have had many opportunities to study this malady in the field in various parts of the country as well as under laboratory conditions. Although the conception of fright disease as an entity may be relatively new, veterinarians have been familiar with the symptoms for decades.[15] In other words, posterior paralysis, epileptiform fits, convulsive seizures and polyneuritic symptoms in dogs, all of questionable or unknown etiology, have long been known.[16] It is only the greater prevalence in recent years that is new. Almost 20 years ago this writer, in common with the practitioners of that day, treated many neurotic and paralytic conditions in dogs medicinally without avail, which he now treats dietetically with success.

We do not mean to state that adequate diet is a panacea for the ills to which a dog may fall heir, nor to leave the impression that bacterial infection or parasitic infestation, for instance, may not produce symptoms similar to dietetic deficiency. We do maintain, however, that many of the symptoms and some of the pathology of several of our canine disease problems of unknown or questionable etiology justify a dietetic investigation.[17]

That dietetic deficiencies can, and often do, cause severe symptoms and marked pathological changes in the animal body, there is no denying;—*e. g.*, rickets, blacktongue, ophthalmia, etc. The day of search for a bacterium to justify pathological changes while ignoring the nutritional equilibrium of a subject is rapidly drawing to a close; as is also the day of the clinician who routinely diagnoses as incurable[18] the patient suffering from certain neurotic or paralytic conditions, or who administers drugs without avail, or with only temporary effect, when he could supply a missing dietary factor with success.

[15] Merillat, L. A., 1923. Is Fright Disease a Special Entity? *Vet. Med.* 18:11, p. 1024.
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[18] Patton, J. W., 1933. Doctor, What Shall I Feed My Dog? *Vet. Med.* 28:3, p. 81; ———, 1933. The Veterinarian and Commercial Dog Foods. *Vet. Med.* 28:3, p. 111.

Veterinarians must be ever mindful of the very important part nutrition plays in animal health. They should bear in mind that relatively few dog foods are so formulated as to provide the daily nutritional requirements of dogs and, further, that few dog owners know, or are in a position to supply, adequate rations to their animals. It follows, therefore, that a large proportion of the dogs brought to the veterinarian for treatment suffer, to a greater or less degree, from one form or another of nutritional inadequacy.

■ The present investigation was undertaken because our attention was called to a commercial food the feeding of which over a period of about a week or ten days in a kennel of valuable dogs produced a nervous - running - howling-convulsion complex diagnosed by the attending veterinarian as fright disease. This was a new experience to this kennel owner. He had considered his dogs as being unusually healthy. These dogs had been fed previously on a commercial dog food that we had reason to know was wholly adequate for their nutritional needs. We knew also from a previous biological assay that the new food was deficient in vitamin B_1.

The relation of food to health and obversely the relation of dietary inadequacies to disease in man are so generally recognized as to require no comment. In the matter of domestic animals, and particularly in the case of the dog, the intimate dependence between diet and disease has received less attention and consequently is not so fully appreciated. More than 30 discussions on this subject have appeared in this magazine in recent years and the available information concerning the nutrition of the dog has been increased manyfold in this way. This discussion adds another common ailment of the dog that is due basically to nutritional inadequacy.

The symptoms which these dogs exhibited when visited and which were related to us by the owner and veterinarian were as follows: The animals ate the food with apparent relish at the beginning, but anorexia developed after a period of five to eight days. This was closely followed by restlessness and nervous irritability in the dogs, manifested by running and howling. There were signs of gastrointestinal disturbance, muscular incoördination and spastic spasms. The din and turmoil were so terrific that the owner expressed fear for the effect on his neighbors. A change of diet to meat and the original food was made, and the symptoms subsided quickly. Our latest information is that all the dogs made a rapid and prompt recovery, and have remained well.

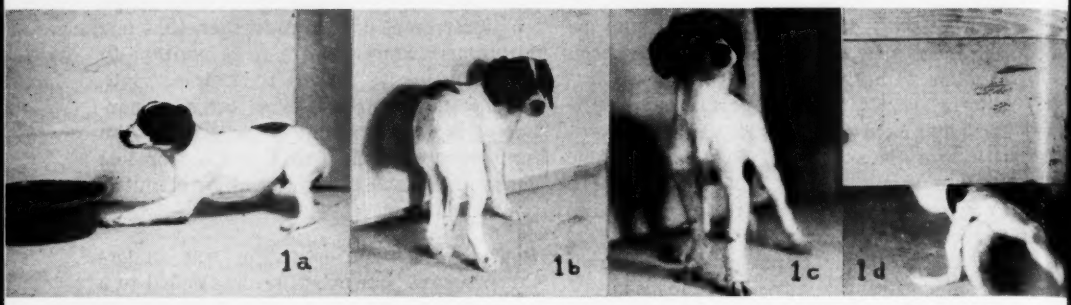


Fig. 1. Fright Disease Due to B_1 Deficiency. Fig. 1a. (No. 61) 3rd day. Early stage—timid, easily frightened, cringes from the hand. Fig. 1b. 3rd day. Very timid and excitable. Startled at drop of pan. Fig. 1c. 4th day. Note wild expression. Ready to start on a running-howling-nervous complex. Fig. 1d. Extremely nervous, fearful, photophobia, seeks seclusion. Spasticity of muscles of hind legs.

A second study of the new food revealed it to be still deficient in vitamin B_1. We then decided to test it on several of our own dogs, whose status of nutritional equilibrium was known, and accordingly procured an additional supply of the food on the market.

■ Perhaps it should be stated by way of background that the occurrence of fright disease in dogs maintained on a ration deficient in vitamin B_1 is not so new as appears in the foregoing. Altogether 51 cases of this malady had developed in our experimental dogs during the past several years, and always in relation to vitamin B_1 deficiency, but in each case the experiment having a different objective than this particular line of investigation, there was no opportunity to follow through to a conclusion on this matter. It may be of interest also that a condition in foxes, almost exactly analogous to fright disease, was produced frequently during a five-year investigation of the vitamin requirements of those animals. The present seemed a good opportunity to study uncomplicated vitamin B_1 deficiency in the dog and to note prodromal and early symptoms which the veterinarian seldom sees, for the reason that he is not often called until the disease is somewhat advanced. Further, as will be explained later, cases occurring naturally are frequently complicated by other deficiencies, particularly vitamin A deficiencies.

■ The present experiments involved two phases—Series I-9, consisting of seven adult dogs, and Series II-9, consisting of six, five-month-old puppies. The dogs used in Series I-9 were selected from our positive control animals. A bio-assayed diet had protected them over a period of many years against the slightest evidence of dietary deficiency. The dogs used in Series II-9 were puppies from a bitch used in the production of standardized pups for experimental use. The bitch and the puppies were on a biologically evaluated diet, calculated to produce a known and adequate state of nutritional equilibrium.

In Series I-9 the food was fed as procured on the market, with the vitamin

supplement hereinafter stated. In Series II-9 the food was autoclaved for two hours at 15 pounds pressure to destroy any vitamin B_1 that might be present. In both series it was mixed with one-half its weight of water and fed at the rate of 200 calories per kilogram of body weight. Records were kept of the amount of feed consumed daily by each dog. The dogs were weighed daily and temperature records were kept. The vitamin supplement given to make certain these dogs should not suffer from any other vitamin deficiency than B_1 consisted of assayed cod-liver oil for vitamins A and D and autoclaved whey for vitamin B_2 (G). This was given to each dog daily by drenching on the basis of each dog's weight, as follows: 60 U. S. P. units vitamin A, eight U. S. P. units vitamin D, and 32 B-S units of vitamin B_2(G) per kilogram of body weight.

■ In Series I-9 the first signs of any deficiency were noticed on, or about, the 10th day after they were placed on the commercial food used by the kennel mentioned. At this time the dogs showed a lessened desire for their food. This is the classical first sign of vitamin B_1 deficiency. As anorexia continued, there was, of course, loss of weight. Within the next 72 hours all the dogs showed varied but very characteristic symptoms of vitamin B_1 deficiency. At this point we initiated treatment with crystalline vitamin B_1 (thiamin chloride). Not all of the dogs exhibited vitamin B_1 deficiency symptoms to the same degree. Dog No. 51, for instance, was the most seriously afected, and dog No. 57 the least affected. These were valuable animals and were desired later for other purposes; hence, the vitamin B_1 deficiency was not allowed to progress to the convulsion stage in all animals, since we did not want to hazard losing them or doing them permanent injury. Nevertheless, the symptoms of fright disease were unmistakable and left no doubt of the early onset of running fits and convulsions in all of them if the deficiency had been allowed to continue for a few days longer.

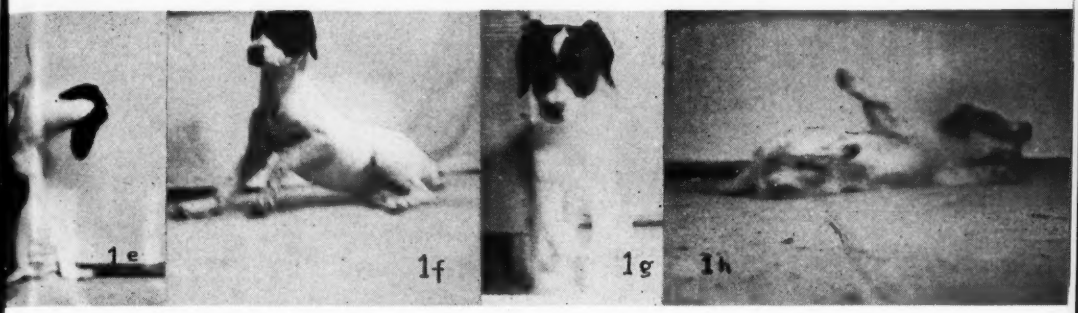


Fig. 1e. 8th day. Marked spasticity of muscles. Unable to run owing to rigidity. Attempts to climb but tumbles back. Fig. 1f. 8th day. Just coming out of a convulsive seizure. Fig. 1g. Fully conscious after a convulsion and wondering what happened to him. Fig. 1h. (No. 62) Clonic convulsion—howling, struggling, foaming at the mouth; a pitiable sight

The early symptoms were, as stated, anorexia, restlessness, and a decline in weight. Shortly thereafter the animals appeared excitable and on slight provocation—the dropping of a pan, the opening of a door, or the barking of other dogs—would frantically rush into a dark corner. They appeared nervous and apprehensive and were given to blindly running when disturbed. There was a distinct distaste for light (flood light used for taking photographs) and a hyperesthesia that caused them to cringe when lightly touched. They howled or barked loudly on the slightest provocation, and even when no one was about.

The foregoing are the characteristic symptoms of vitamin B_1 deficiency, and of course they closely resemble those of fright disease. They do not, however, duplicate the symptoms seen in naturally-occurring

cases so closely as those observed in Series II-9, where the animals were held in a state of acute vitamin B_1 deficiency for a longer period.

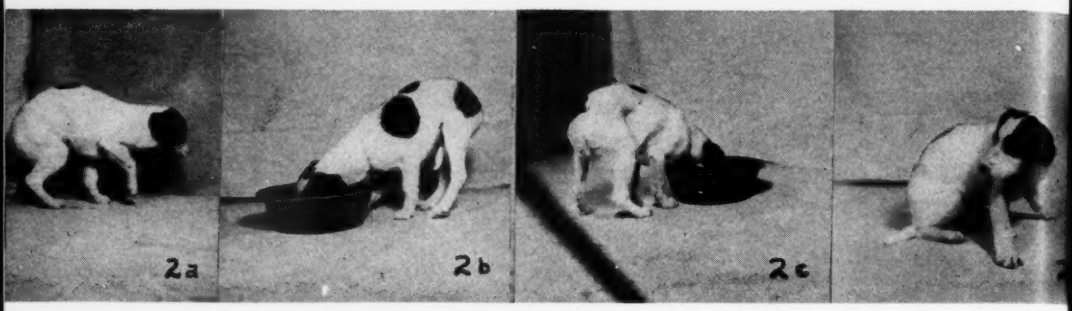


Fig. 2a. (No. 58) Characteristic early attitude; timidity and whipped appearance. Fig. 2b. Early stage. Very characteristic attitude at feed pan—all feet bunched together, somewhat unsteady, braces self with nose. Hyperesthesia. Fig. 2c. More advanced symptoms of incoördination. Posterior weakness, braces self to stand, sometimes lifts both hind feet off the floor. Muscles of the hind quarters very spastic. Fig. 2d. Weak behind, sits down to eat, braces the feet far apart. Wabbly when he walks.

■ In Series II-9 the dogs manifested the symptoms of B_1 deficiency in less than half the time required to produce this deficiency in the Series I-9 dogs. This is probably to be explained in part by the fact that Series II-9 were young, growing dogs, while Series I-9 were mature, and in part by the further fact that these dogs were totally deprived of B_1 (by autoclaving the food), while the older dogs possibly received some, although an inadequate portion, of B_1 in their food.

CASE NO. 62, SERIES II-9

Female, mixed breed; age 22 weeks; weight 9 lbs. 15 oz.

1st Day.—Put on vitamin B_1 deficient diet.

2nd-3rd Days.—Appears normal.

4th Day.—Morning: inappetence; restless; crouching; slinking gait; howling; photophobia.

Evening: Same symptoms; also spasticity of muscles; seeks seclusion; eats in seclusion; runs away; very timid.

5th Day.—Symptoms the same as previous day, but more marked.

6th Day.—Posterior weakness, wabbly gait; nervous and irritable; runs, howls and clamps jaws; eats with difficulty.

7th Day.—Morning: same symptoms as preceding day, and in addition attempts to climb walls.

Evening: Does not eat; very nervous; has running, howling convulsion.

8th Day.—Morning: opisthotonos; very nervous and irritable; chorea-like movements of the head; eats one-third of feed.

Evening: same, except does not eat.

9th Day.—Sits hunched up with head drawn back; four convulsive seizures observed (there may have been others), with clonic convulsion, threshing around; running, howling, yelping when moved; climbs the wall and falls backward; does not eat.

Treatment: one grain sodium amytal at 11:00 a. m. and at 5:00 p. m.; also 500 I. U. of thiamin hydrochloride subcutaneously at 5:00 p. m.

10th Day.—Nervous and irritable, but much improved over previous day. Eats half its feed.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

11th Day.—Almost normal; friendly; eats normally.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

12th Day.—Normal.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

13th Day.—Normal.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously in morning; 150 I. U. thiamin chloride orally in the evening.

14th Day.—Normal.

Treatment: 150 I. U. thiamin chloride orally.

15th Day.—Normal.

Treatment: None.

16th Day.—Slightly nervous.

Treatment: None.

17th Day.—Early symptoms of acute vitamin B_1 deficiency.

Treatment: 300 I. U. thiamin chloride orally.

18th Day.—Normal except jittery.

Treatment: 300 I. U. thiamin chloride orally. Returned to adequate diet.

19th Day.—Normal.

Precautionary Treatment: 150 I. U. thiamin chloride orally.

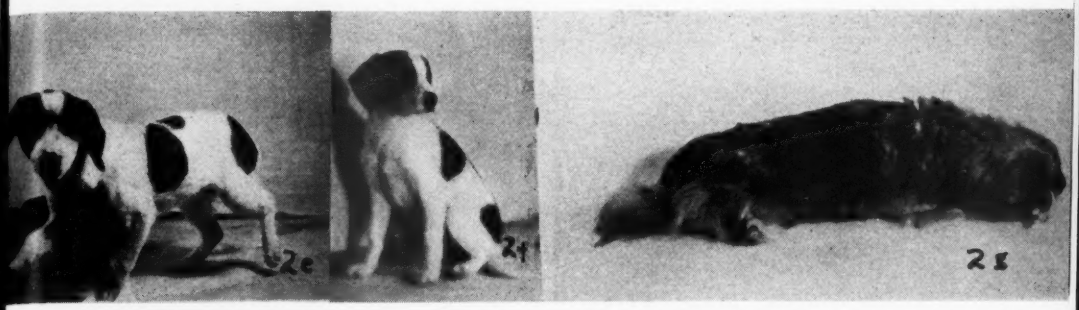


Fig. 2e. Starting frantically and blindly for parts unknown. Fig. 2f. Twenty-four hours after treatment was commenced. Appearance and action nearly normal. Fig. 2g. (No. 51) Severe paraplegia and also weak in front; the condition on the 11th day. Paraplegia that appears early is very stubborn; that appearing later yields promptly to treatment.

20th Day.—Normal.

Precautionary Treatment: 75 I. U. thiamin chloride orally.

21st and Subsequent Days.—Normal.

CASE NO. 58, SERIES II-9

Female, mixed breed; age 22 weeks; weight 13 lbs. 2 oz.

1st Day.—Placed on vitamin B_1 deficient diet.

2nd Day.—Apparently normal.

3rd Day.—Some anorexia, irritable.

4th Day.—Morning: eats one-third of feed; nervous, irritable, timid; runs away; howls.

Evening: running - howling - barking complex; climbs walls and falls backward.

Treatment: 35 I. U. tiki tiki (concentrated rice polishings).

5th Day.—Good appetite; slightly excitable, nervous, but much improved.

Treatment: 35 I. U. tiki tiki.

6th Day.—Hyperesthesia; wabbly gait; climbing walls and falling backward; opisthotonos and emprosthotonos; can stand only with great difficulty; nose-dives into feed pan with hind feet off the floor.

Treatment: 10:00 a. m., 35 I. U. tiki tiki; 5:00 p. m., 500 I. U. thiamin hydrochloride subcutaneously.

7th Day.—Morning: hyperesthesia; nervous, irritable, timid; eating fairly well; much improved.

Evening: same symptoms, but ameliorated; normal gait and normal position at the feed pan; improved.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

8th Day.—Much improved; normal except restless and fidgety.

Treatment: None.

9th Day.—Morning: nervous, irritable; emprosthotonos; incoördination; barking, running, and howling.

Evening: same symptoms, but more pronounced; eats only half-portion of feed.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously at 4:00 p. m.

10th Day.—Morning: improved.

Evening: further improvement.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

11th Day.—Normal, playful; good appetite.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

12th Day.—Same as preceding day.

Treatment: 150 I. U. thiamin chloride orally.

13th Day.—Same as preceding day.

Treatment: 150 I. U. thiamin chloride orally.

14th Day.—Normal.

Treatment: None.

15th Day.—Apparently approximately normal.

Treatment: None.

16th Day.—Marked symptoms of vitamin B_1 deficiency.

Treatment: None.

17th Day.—Convulsions; one running fit.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

18th Day.—Much improved.

Treatment: 300 I. U. thiamin chloride orally. Returned to adequate diet.

19th Day.—Normal.

Precautionary Treatment: 150 I. U. thiamin chloride orally.

20th Day.—Normal.

Precautionary Treatment 75 I. U. thiamin chloride orally.

21st and Subsequent Days.—Normal.

CASE NO. 61, SERIES II-9

Male, mixed breed; age 22 weeks; weight 11 lbs. 1 oz.

1st Day.—Put on vitamin B_1 deficient diet.

2nd Day.—Apparently normal.

3rd Day.—Somewhat timid; seeks dark corners; some anorexia.

4th Day.—Increased anorexia; nervous, irritable; seeks dark corners; clonic, spastic muscular condition; constipation; howling; climbing wall and falling backward.

5th Day.—All symptoms of previous day more pronounced; inappetence; coprophagy; trembling; frequent micturition; yelping, running, and howling.

Treatment: 35 I. U. tiki tiki, 10:00 a. m.

6th Day.—Same symptoms as previous day, but less pronounced; apparently a little improved; eats all its feed; vomiting.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

7th Day.—Morning: nervous and excitable, but spasticity of muscles absent; gait normal; eats; much improved.

Evening: much improved.

Treatment: None.

8th Day.—Morning: excitable, nervous, irritable; runs, howls.

Evening: not eating; runs, howls; convulsive seizures; climbs wall and falls backward; wabbly gait; falls down and stiffens—very rigid.

Treatment: 250 I. U. thiamin hydrochloride subcutaneously.

9th Day.—Morning: nervous, excitable; runs and howls; hyperaphia; spastic muscular condition; inappetence.

Evening: eats half-portion of feed; better muscular coördination; still nervous and restless.

Treatment: 100 I. U. thiamin hydrochloride subcutaneously, 3:00 p. m.

10th Day.—Morning: steppage gait (one step at a time, very deliberate; raises feet high and puts them down quickly); eats; nervousness and irritability have almost disappeared.

Evening: no change.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

11th Day.—Morning: eats all feed; much less nervous and irritable; friendly; slight spasticity, somewhat wabbly.

Evening: very much improved over morning.

Fig. 3. Fright Disease Due to B_1 Deficiency. **Fig. 3a. (No. 63) Early stage, timid, fearful, yelping. Photophobia. Would eat if alone. Fig. 3b. Extremely nervous. Jumps back when the pan is moved. Note tail between legs and braced hind legs. Spasticity behind. Fig. 3c. Unsteady, braced fore and aft, spasticity extends to all quarters, muscles becoming rigid, wabbly gait. Marked hyperesthesia.**

Treatment: 500 I. U. thiamin hydrochloride subcutaneously, 10:00 a. m.

12th Day.—Morning: eating well; almost normal.

Evening: eating well; slight steppage gait; otherwise nearly normal.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously.

13th Day.—Normal.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously; 150 I. U. thiamin chloride orally.

14th Day.—Normal.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously; 150 I. U. thiamin chloride orally.

15th Day.—Normal.

Treatment: 150 I. U. thiamin chloride orally.

16th Day.—Normal.

Treatment: None.

17th Day.—Irritable, restless, noisy.

Treatment: None.

18th Day.—Early symptoms of acute vitamin B_1 deficiency.

Treatment: 500 I. U. thiamin hydrochloride subcutaneously at 9:00 a. m. Returned to adequate diet.

1:00 p. m.: much improved.

19th Day.—Normal.

Precautionary Treatment: 150 I. U. thiamin chloride orally.

20th Day.—Normal.

Precautionary Treatment: 75 I. U. thiamin chloride orally.

21st and Subsequent Days.—Normal.

This being a pure vitamin B_1 deficiency without complications, the symptoms displayed by the dogs in Series II-9 were ex-

tremely uniform, so much the same as to make it unprofitable to give them in detail for each animal. The detailed report of cases 58, 61, and 62 may in general be taken for any of the others. It seemed futile to permit any of these animals to die. Everyone knows that although a convulsion is only a symptom, a dog may die of it, or at least in it, if it be severe enough, and each of these dogs suffered alarming convulsions so severe that in some cases death was expected momentarily and they were weak and dopey for hours afterward.

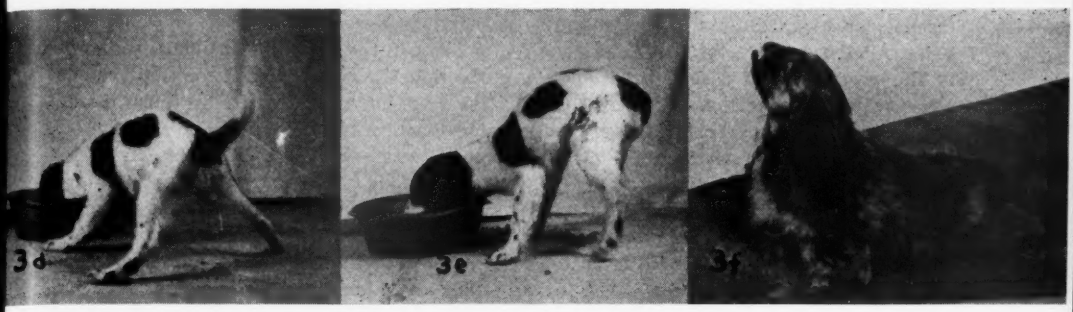


Fig. 3d. All symptoms more marked than in 3c; posterior parts somewhat paralyzed; rests weight on fore legs. Wabbly gait. Fig. 3e. Very unsteady on feet. Tendency to sit down much of the time. Acute hyperesthesia. Fig. 3f. (No. 51) Posterior paralysis 9th day). Almost the first symptom shown by this dog of Series I-9.

B_1 is not stored in the body to the same degree as some other vitamins, except in the hog. Other animals, except ruminants,* require a daily intake or suffer from its deficiency in a very short period. In these dogs after the disease was well established we could produce convulsions and all the other symptoms at will by simply withholding the thiamin hydrochloride. When the condition was far advanced it did not respond to oral administration, possibly because of faulty assimilation, or it may have been because the quantity given was insufficient. Insufficient quantity may also account for the failure of tiki tiki, which at first relieved the patient (Case No. 58), but permitted a relapse the following day. The effect of the injection of 500 I. U. of the pure salt B_1 (thiamin hydrochloride) was nothing less than spectacular. It transformed a racing, howling maniac, or one in appalling convulsions, frothing at the mouth and screeching piteously, into a quiet though nervous animal within four hours, and in 48 hours into a normal, healthy, playful puppy. The hypodermic injection of 250 units once daily ameliorated the symptoms but was insufficient for a cure in well developed cases.

■ One is not justified in saying that every case that has been diagnosed as fright disease was essentially a case of B_1 deficiency. Until the cause of any disease is known, different entities are quite apt to be grouped with it. Glanders is an outstanding example of a name that was once applied to a group of diseases but with better understanding has been narrowed to a single definite entity. Nor, as has been explained, can naturally occurring cases be expected to be always or even generally devoid of complications, a characteristic of experimentally induced cases. However, for cases of fright disease as they generally occur in the practice of veterinarians it may be said that B_1 deficiency is the critical factor and the treatment consists first in supplying this deficiency by a hypodermic injection of 500 I. U. of vitamin B_1 (for young dogs weighing approximately 12 pounds) daily for two or three days and a change to a diet adequate in B_1. To this must be added treatment for any complications that exist. As mentioned earlier, if the B_1 deficiency has developed slowly it is likely to be complicated by vitamins A and B_2 deficiencies also. It has been stated that in naturally

*Ruminants synthesize this vitamin in the rumen by means of a bacterial symbiosis.

occurring cases the dogs that suffer from B_1 deficiency are likely to suffer also from other deficiencies. Vitamin B_1 is easy to supply and a ration that lacks it does so in most instances because of ignorance, indifference, or niggardliness of the manufacturer. All these characteristics tend equally to the production of a food inadequate in other respects as well as in vitamin B_1. A dog existing, for example, on the borderline of vitamin A or vitamin B_2 (G) deficiency, or both, upon coming down with acute B_1 deficiency decreases its food intake for several days or longer, sometimes by as much as 75%. Of course it decreases its vitamin A and vitamin B_2 (G) intake by the same percentage, and in borderline cases this may be sufficient to precipitate acute deficiencies of one or both of those vitamins also.

Since animals suffering from B_1 deficiency have an irresistible tendency to eat all manner of unusual and even disgusting objects, the possibility of foreign objects[19] in the stomach or intestine should not be forgotten. Since attacks are often precipitated by work[20], febrile disease parasites, etc., the possible presence of such conditions should receive consideration.

Fright disease as a result of vitamin B_1 deficiency in dogs used in experimental work is not new. Goldberger[21, 22] saw it but at that time the B complex was little understood and he mistook it for prodromal symptoms of blacktongue. Cowgill[23] described it in great detail, but possibly being unfamiliar with the disease as it occurs naturally, he failed to recognize the significance of it. Other experimenters[24, 25, 26] likewise have overlooked its importance.

■ The function of vitamin B_1 in animal nutrition has been extensively explored by scientific investigation. It is essential for appetite and proper functioning of the gastrointestinal system and for nuclear metabolism. It contributes to normal growth, reproduction, and lactation. There is some evidence that it increases resistance to infection.

In absence of vitamin B_1 or when it is present in the ration in insufficient amount, the appetite is diminished for that particular food, but the animal may relish a similar food containing adequate B_1. There is impaired growth, loss of weight (from lessened food intake), weakness, impaired carbohydrate metabolism, hyperglycemia, cardiovascular disturbance, involvement of the nervous system, muscular incoördination and alimentary disturbance.

The effect of vitamin B_1 deficiency on carbohydrate metabolism is particularly interesting in a discussion of fright disease. This vitamin is concerned with the removal of oxidation products of carbohydrate metabolism. Veterinarians have long spoken of certain dogs as being "burned out on starches" and recommended a meat and milk diet, which in such cases rekindles the fire of appetite. This diagnosis is not without reason and the remedy is logical. The condition is better described as a damming back of the products of carbohydrate metabolism due to lack of vitamin B_1 in the diet and the remedy amounts to supplying this lack. Linton[27] (Edinburgh) states that many veterinarians and dog owners, at least in Britain, believe that a deficiency of the vitamin B complex is partly if not wholly responsible for canine hysteria. After a study of the disease in that country (1938) I am in full accord with Linton that some fraction of the B complex is responsible. Frink[28] states that he has very rarely, if ever, been called to treat a dog for fright disease that had been fed plenty of lean meat.

Many veterinarians have noted the frequency with which fright disease occurs simultaneously with some other malady—distemper or other infection, severe parasitism,[29] a major surgical operation—and equally often it has been noted to occur in

[19] Campbell, D. M., 1927. Epizoötic Hysteria. *Vet. Med.* 22:3, p. 102.
[20] W. H. B., 1923. Fright Disease Not Confined to the South. *Vet. Med.* 18:3, p. 268.
[21] Campbell, D. M., 1930. Yeast a Preventive of Canine Hysteria. *Vet. Med.* 25:7, p. 276.
[22] Campbell, D. M., 1933. Fright Disease a Vitamin B Complex Deficiency. *Vet. Med.* 28:12, p. 511.
[23] Cowgill, G. R., 1935. "The Vitamin B Requirements of Man." New Haven: Yale University Press.
[24] Funk, Casimir. "The Vitamines."
[25] Mathews, A. P., 1937. "Vitamins, Minerals and Hormones."
[26] Sherman, H. C., and S. L. Smith. "The Vitamins."
[27] Linton, R. G., 1934. Canine Nutrition. *Vet. Med.* 32:2, p. 86.
[28] Frink, W. E., 1932. Canine Hysteria. *Vet. Med.* 27:2, p. 77.
[29] Springer, Geo. E., 1925. Fright Disease in Dogs. *Vet. Med.* 20:4, p. 175.

hunting dogs[30] when at work and to disappear when they were rested for a few days, to return when again taken afield. This is characteristic of vitamin B_1 deficiency, the equilibrium for which depends upon the relation of intake and demand. Anything that increases the demand (fever, exercise,[31] the drain from parasites,[32] lactation, etc.), or lessens the intake (restriction of food following anesthesia, starvation, acute indigestion, etc.), may furnish the spark to set off the explosion in borderline cases. To understand the idiosyncrasies of this particular deficiency it is worth repeating that except in the pig this vitamin is not stored in the body tissues to any considerable extent, and that deprivation of it even for a short period of time means disaster. In borderline cases anything whatever that lessens the intake of food or increases the metabolism[33] accentuates the deficiency and nears the point where all the troubles of Pandora may be turned loose upon the unhappy victim.

■ It is interesting to examine in retrospect the occurrence and extension of fright disease in this country. In the main it came upon our dogs during the meatless days of the World War period. It increased phenomenally during the years immediately following, when our food habits underwent a marked change; when the grocery and meat market became dealers in packaged goods and countless thousands of delicatessen shops took over much of the cooking formerly done in the home kitchens; that is to say, when scraps suitable for dog feed largely disappeared from the meat market, the kitchen and the dining-room table, and urban dog owners turned to commercial foods for the sustenance of their pets. Rarely has it been charged to canned dog food, although beyond any question many of the cheaper brands will cause or prepare the field not only for this deficiency, but for every other malady to which dog flesh is heir. Upon dry dog food the major responsibility has been placed, and correctly. Until the rottenness of the dry food industry was exposed in this magazine[34] one could count on the fingers of one hand the manufacturers that used any food of animal origin in their biscuits, crumbles or meal other than meat cake or tankage. In processing, both articles are heated far beyond the point at which vitamin B_1 is destroyed. The cereals used contain little or none of this vitamin. The dog fed upon such food was doomed unless it could raid prolific garbage cans regularly, forage far afield, eke out his inadequate ration with table scraps or share the family's portion of meat, fish, cheese, butter, milk or eggs.

Conditions are better now, thanks to some justified muck raking,[35] but the majority of dog foods still are made to sell and to fill a dog, with nutrition the least of considerations. The only safe way, even yet, is for veterinarians to warn their clients against any but the foods of manufacturers who supply an honest product; who have gone to the trouble and expense of formulating a food on scientific principles under the guidance of competent nutritionists; who are proud of their products and are not only willing but anxious to supply veterinarians with every detail concerning them, and particularly with the reports of competent biochemists upon them. There are a number of such foods. They are better than anything the owner can prepare for himself. Dogs fed upon them thrive and make satisfactory companions. Beware of the food manufacturer who does not court the approval of the veterinarian. His food probably doesn't deserve such approval. Demand always the scientific facts as to the adequacy of a dog food, nor stop with approval of the label. The label may be truthful but say nothing of significance. At present in most states there is no regulation of this industry except the consciences of those in it.

[30] Virginia, 1924. Beagles Have Fright Disease. *Vet. Med.* 19:1, p. 39.
[31] C. H. D., 1926. Running Fits in Dogs. *Vet. Med.* 21:5, p. 250.
[32] Horning, J. G., and A. J. McKee, 1924. Ancylostomiasis a Factor in Fright Disease. *Vet. Med.* 19:12, p. 667.
[33] Phillips, D. M., 1928. Running Fits. *Vet. Med.* 23:1, p. 34.
[34] Patton, J. W., 1932. Biological Analysis of Commercial Dog Foods. *Vet. Med.* 27:8, p. 324; ———, 1932. Further Studies on Commercial Dog Foods. *Vet. Med.* 27:12, p. 530; ———, 1935. Cheap Dog Food a Delusion. *Vet. Med.* 30:1, p. 13; ———, 1935. Proposed Dog Food Standards. *Vet. Med.* 30:3, p. 128.
[35] Campbell, D. M., 1936. The Dog Food Racket. *Vet. Med.* 31:6, p. 238.

Canine Pediatrics

XII. Practical Suggestions for Puppy Feeding*

By D. M. CAMPBELL, Chicago, Illinois

EVERY year millions of parents, with no more than the barest knowledge of the basic principles of nutrition, successfully feed their babies on artificial formulas. This consistent success is possible partly because the vast body of abstract and practical data on infant feeding that has been built up through the decades by the sciences of nutrition and pediatrics may be reduced, under the direction of the pediatrician, to easy, almost rule-of-thumb routine procedures which parents can readily follow.

It is important, however, that the professional man who provides his clients with practical instructions understand fully the implications of the research and clinical data on which they are based and that the directions themselves represent an adequate and up-to-date synthesis of such data.

It is with this view that VETERINARY MEDICINE concludes the series of articles on Canine Pediatrics with summarized and tabulated working data, which should prove understandable to the dog owner or kennel man, and with which the veterinarian, in the practice of canine pediatrics, may equip his clients to guide them in the routine of day-to-day feeding of puppies. To the veterinarian who has followed the exposition of research work and nutrition concepts upon which the program for the artificial feeding of very young puppies was built, as detailed in previous articles in this series, such outline and tabulation undoubtedly will seem elemental. Yet it would be impractical for the veterinarian personally to conduct or supervise every operation necessary in the feeding of puppies. The actual work of preparing the simulated bitch's milk formula and feeding the puppies must be done by the dog owner or the kennel man who will require instructions that he can follow readily. It is suggested that the veterinarian obtain reprints of these data, which may be kept on hand for ready reference or handed to clients to supplement the veterinarian's supervision and instructions.

The initiation of artificial puppy feeding, like much other veterinary work, is often of an emergency nature, and the veterinarian who contemplates undertaking it should have at hand a moderate supply of the necessary ingredients and utensils. Procuring such articles from grocers, druggists and other sources at say two a. m. on Sunday may be anything but a simple procedure. Further, it adds to the dog owner's confidence in the veterinarian and in the method he recommends if he is able to initiate the feeding schedule at once with all necessities provided. In a few days the dog owner can, of course, procure his own and return the veterinarian's equipment if the latter does not care to supply all or any part of it for permanent use.

Weighing

Equipment.—The beam-type scale is recommended in preference to the spring scale because of its greater accuracy. The scale should read in grams in order to be particularly adaptable for use in obtaining accurate weights for puppies of all breeds. A solution scale, type triple beam balance No. 17026, capable of weighing up to 2610 grams with a sensitivity of 1/10 of a gram, may be purchased from Eimer and Amend Co., Third Ave., 18th to 19th Sts., New York, N. Y., for about $15.00. (A scale of this type has the additional advantage of being suitable for measuring accurately the amount of simulated bitch's milk required for one day's formula in all cases where the dry,

* Prepared in collaboration with Dr. G. C. Supplee and Mr. J. H. Le Ware, Borden Research Laboratories, Bainbridge, N. Y. This is the twelfth and final article in a series on the nutrition of young puppies.

powdered form of simulated bitch's milk is used.)

Procedure.—Very young puppies should be weighed daily to determine growth progress. Weigh at a standard time of the day, preferably around noon, about four hours after one of the regular feeding intervals. This will give an average weight when the puppy is neither full of ingested formula, nor entirely depleted of liquids or solid visceral content. Daily weight and gain or loss should be recorded on a suitable chart. Printed or mimeographed forms will be found a convenience if not an actual necessity.

In order to determine the amount of milk a suckling puppy is obtaining from the bitch, the puppy may be weighed before a suckling period and immediately after suckling. Subtract the lesser weight from the greater to determine the weight of the ingested milk. This procedure requires controlled rather than random suckling periods. It may be of value frequently in determining the adequacy of the bitch's milk supply. It also may be employed with an artificially-fed puppy to determine whether the puppy is ingesting the full amount of formula required or whether it is spitting or spilling some of it.

Preparation of Formula

The feeding of very young puppies on simulated bitch's milk formulas should be conducted with painstaking care and should be considered as a specific duty to be carried out with regularity and precision. It should not be looked upon as secondary to other routine work or as an appendage to household duties. For obvious sanitary and esthetic reasons, special utensils and equipment should be obtained for the feeding of puppies, and they should be cared for and stored separately from household dishes and pans.

The carefully worked out caloric and fluid intake ratios, based on the body weight of the puppy, which in clinical tests have been demonstrated to be optimum for artificial feeding of young puppies, require accuracy and care in the mixing of ingredients for best feeding results.

Daily accurate weighing of puppies and the provision of accurate amounts of simulated bitch's milk are of particular importance during the early life of the puppy to avoid intestinal upsets due to underfeeding or overfeeding. It is important in all cases that the simulated bitch's milk be measured accurately; by volume (cc.) where the 24%-solids sterilized fluid form is used, and by weight (grams) where the dry powder form is used.

Equipment.—For measuring fluids: A pyrex graduate, marked in cubic centimeters, obtainable at drug stores, department stores and pharmaceutical supply houses, and a glass, porcelain or enamelware measuring spoon or cup, accurately marked for cubic centimeters or teaspoons, obtainable from pharmacy or from medical supply houses should be provided.

For measuring solids (dry powder form of simulated bitch's milk): Use the same beam-type scale recommended for weighing puppies. It is recommended that no attempt be made to use the volumetric method in approximating correct amounts of powder because inherent inaccuracies of such system might, in some cases, endanger the success of the entire feeding program.

For heating and mixing formula: Use an enamelware saucepan or stewpan, with cover, capacity one or two quarts, and an

enamelware, glass, or metal mixing spoon.

For storing formula mixture: Glass containers of suitable size with cover, or glass or pyrex infant's nursing bottles, four- or six-ounce capacity, are desirable. As a temporary makeshift in an emergency, medicine droppers inserted through rubber corks into ordinary four-ounce bottles will serve, but because of the difficulty of cleaning them should not be relied upon for permanent use. A hole can be made in the rubber bulb of the medicine dropper with a hot pin.

For pouring mixture into nursing bottles: A glass, pyrex, or enamelware funnel is satisfactory.

Procedure.—Determine weight or weights of puppy or puppies and total amount of formula required for 24-hour period (consult Puppy Feeding Schedule, Table III, given in the ninth article of this series, VETERINARY MEDICINE, February, 1939, p. 125).

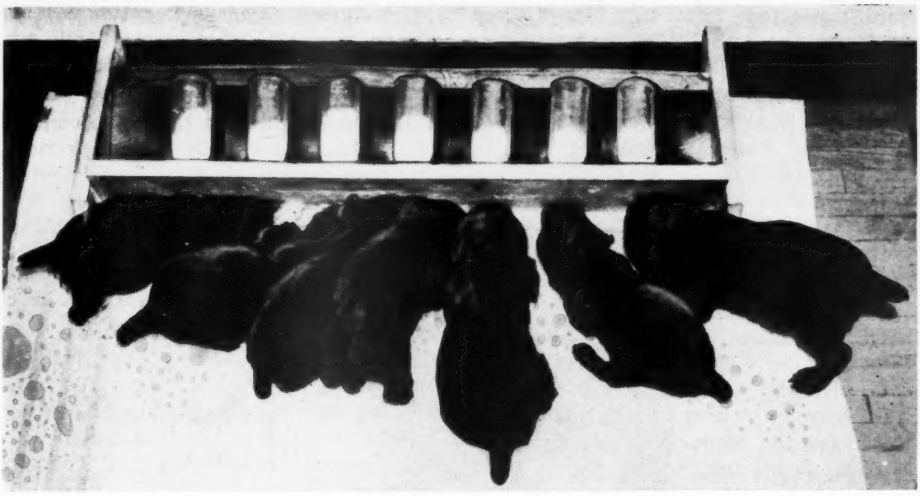
Warm the correct amount of water to blood heat (100°F.). Previously sterilizing the water by boiling for three minutes is a precaution deemed advisable by many veterinarians. Measure the required amount of simulated bitch's milk preparation and add to the water; stir briskly with an egg beater, fork or spoon, until thoroughly dissolved and mixed; pour into a clean container for storage or for feeding, and cover. If the mixture is poured into nursing bottles, they may be plugged with sterile cotton until ready for use. Never prepare more formula mixture than is required for one, 24-hour, feeding period. This prepared mixture should be kept under refrigeration until ready for use. As previously emphasized, vessels, egg beater and all utensils that come in contact with the food must be scrupulously clean to avoid diarrheas and other intestinal upsets in very young puppies.

Feeding of Puppies

Equipment.—Infant nursing bottles: Four or six-ounce size, glass or pyrex (or any other bottle of suitable capacity which will accommodate nipple and permit thorough cleansing) are necessary. These may be obtained at department stores and drug stores.

Nipples: Special puppy nipples are recommended as most adaptable in all cases and for all breeds and sizes of puppies. These nipples are slightly smaller than infant feeding nipples, but they can be used readily with standard infant nursing bottles. R. H. Macy & Co., Inc., Broadway and 34th St., New York, N. Y., supplies such nipples at 14 cents each. Less suitable, but satisfactory for large breeds of puppies, are the smallest size infant's nursing nipples (Anti-Colic brand, No. 151 and No. 137, manufactured by Davol Rubber Co., 69 Point St., Providence, R. I., and obtainable at most drug and department stores). R. H. Macy & Co., and Abercrombie & Fitch Co., Madison Ave. at 45th Street, New York, N. Y., also supply puppy feeding bottles, complete with graduated glass container, rubber valve and nipple; these are useful chiefly for feeding very weak or sick puppies.

Procedure.—Warm the simulated bitch's milk to approximate body temperature (100°F.). Make certain that holes in each nipple are large enough to permit slow, steady dripping of the contents when the bottle is turned upside down, but not so large as to permit a too rapid flow and cause the puppy to choke. The flow should be slow enough to cause the puppy to suck the nipple with some vigor. Hold the bottle in a manner to prevent the ingestion of air with the food; if the puppy sucks in air, it will regurgitate, and may suffer abdominal pain. Do not try to force the puppy to take more than its capacity, nor more than the amount prescribed for its age and weight. Feed at regular eight-hour intervals, not oftener; but do not miss any feedings except for therapeutic purposes under the veterinarian's direction. (For further details of feeding regimen see Article IX in this series: "Regimen for Artificial Feeding of Very Young Puppies", VETERINARY MEDICINE, February, 1939, pp. 123-129).



HOMEMADE RACK FOR HOLDING NURSING BOTTLES

Note that the inclination of the bottles is such that the puppies will not swallow air with the milk, yet they can reach the nipples readily when in normal nursing position. The picture also illustrates the necessity for watching the puppies while they are feeding to prevent some getting more than their share and others less.

Care and Cleaning of Utensils and Equipment

Equipment.—A clean, dust- and vermin-proof box or cabinet for storage of all feeding and mixing utensils; nipple brush and bottle brush (obtainable from drug or hardware stores); soap, wash cloths, towels, scouring powder (bab-O, old Dutch cleanser, bon ami, or other standard brands obtainable from drug and grocery stores); glass container with cover for storage of clean nipples and a dishpan for washing utensils are essential.

Procedure.—All equipment used in preparation or feeding of the formula mixture should be cleaned thoroughly after use, dried, and placed in storage box or cabinet in readiness for subsequent use. Enamelware pans should be cleaned inside and out with scouring powder, then washed thoroughly in hot soapsuds, rinsed in warm, clear water, and dried. Nipples and bottles should be rinsed with cold water immediately after use. They should subsequently be cleaned thoroughly with nipple and bottle brushes in hot, soapy water, rinsed in warm, clear water. Spoons, graduates, funnels, etc., should be washed similarly. If infectious disease is present in the kennels all articles used in preparing formula and in feeding should be cleaned with water to which some antiseptic preparation has been added. Phenol preparations (lysol, CN, etc., obtainable from druggist or grocer) are effective; but if used, care must be taken to rinse thoroughly to remove disagreeable taste and odor. Chlorine preparations (chlorox, etc., obtainable at grocery or drug stores) also may be used. Boiling is one of the surest means of sterilizing equipment and may be used where circumstances warrant.

Simulated Bitch's Milk

The Borden Research Laboratories, where the artificial bitch's milk discussed in this series of articles was developed, does not market the product, nor does The Borden Company, of which the laboratories are a subsidiary, distribute the product. It may be obtained, however, in concentrated form, ready for solution or dilution, to make the artificial bitch's milk with which the experiments described in preceding articles

were conducted, from the Gaines Food Company, Sherburne, N. Y., by which it is marketed under the name of "Formula 107-A" (powder form), and from Chappel Bros., Inc., Rockford, Illinois, by which it is marketed under the name of "Ken-L-Lac" (liquid form). Another artificial bitch's milk may be obtained from Life Products, Inc., 25 Prospect Ave., N.W., Cleveland, Ohio, by which it is marketed under the name of "Ween" (liquid form).

Both The Borden Company, which prepares Formula 107-A and Ken-L-Lac, and the S.M.A. Corporation of which Life Products, Inc., which prepares Ween, is a subsidiary, are large producers of infant foods that have the approval of the American Medical Association. The puppy foods Formula 107-A, Ken-L-Lac and Ween are made with all the care, all the regard for cleanliness and proper composition that is observed in the preparation of their infant foods. They are thoroughly dependable products.

To the manufacture of both of these artificial milks have been brought the training and skill acquired over a long period in the production of food for human babies, which has been an important factor in reducing their death rate from 157 to 52 per thousand. These artificial milks are not to be regarded as modified cow's milk. That, even when altered to be chemically similar to bitch's milk, does not meet the requirement, many puppies being allergic to it.

Chemically, the formula of the simulated milk developed by the research described in this series of articles, is very similar to bitch's milk. When the formula is diluted for feeding it compares with the average of natural bitch's milk, as shown in the following table:

	Bitch's Milk	Simulated Bitch's Milk
Fat	9.00%	8.20%
Carbohydrates	3.10%	2.87%
Protein	8.00%	7.63%
Ash	0.90%	1.16%
Calories per gram	1.28	1.18

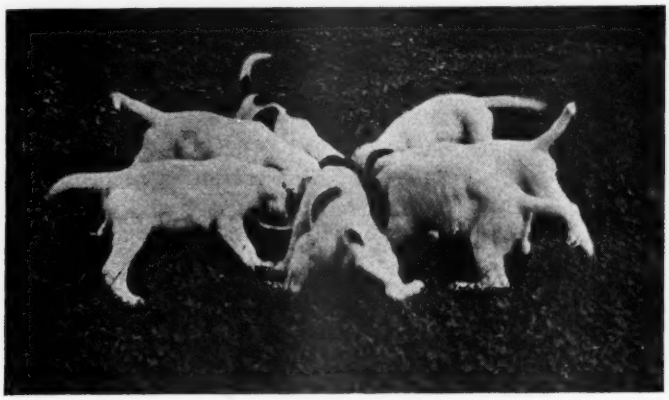
The ingredients include: cottonseed oil, skim milk, casein, butter, lactalbumin, egg yolk (2.8%), lactoflavin concentrate (2%), and minerals (2.3%).

While, as will be seen, the gross composition of the simulated bitch's milk conforms closely to that of the lacteal secretion of the dog, it cannot be assumed that the nutritive characteristics of the simulated product are predicated solely upon the similarity in chemical and calorific composition. Simulated bitch's milk as developed by the Borden Research Laboratories, while of necessity closely approximating the composition of bitch's milk, is compounded with a delicate balance between proteins, fats and carbohydrates, and individual mineral constituents. Not only are cow's milk and cow's milk derivatives employed in its manufacture but, for example, fats of different origin are also used in order that the fat component of the simulated product may be more appropriate for the nursing pup than is the fat of cow's milk. Likewise, the protein component of the simulated product, while derived in part from the protein of cow's milk, contains also protein rich in certain amino acids which the protein of cow's milk does not contain in abundance.

Not only have the fat and protein components of the simulated product been blended by appropriate entities of different origin, but these components have been further selected and processed to suppress allergic reactions common to many natural proteins due to interspecific differences. The state of dispersion and balance between the protein component and substances physically or prosthetically associated with protein appear to be important factors affecting the allergic characteristics of foreign proteins. This problem has been recognized in the development of simulated bitch's milk, and the endeavor has been to eliminate or to suppress this type of adverse reaction to the highest possible degree.

The "trace" components, including vitamin and mineral additions, represent a philosophy of dietary compounding, the

practice of which promises to increase markedly in scope in the field of human nutrition during coming years. Nutritional science has clearly disclosed that no single degree of adequacy of the ration of the bitch during the gestation and suckling periods. The nutritive enhancement of the simulated product with such factors per-



Five-week-old puppies, fed on simulated bitch's milk. —*Photo courtesy of John N. Eidel, Gunmoor Training Kennels, Wappingers Falls, N. Y.*

food as produced by nature contains an optimum quantity and ideal balance of *all* the complex entities required for maximum nutrition. The blending and fortification of dietary substances in order to secure an optimum nutritive balance for the individual subject, are rapidly becoming recognized as utilitarian practices in the light of the growing mass of data revealed by basic investigations in the field of biochemistry as applied to nutrition. The lessons taught by such researches have been applied in the compounding and preparation of the simulated bitch's milk, especially in respect to the enhancement of the basic formula with vitamins, both water- and fat-soluble, as derived from natural materials. Likewise, the simulated bitch's milk contains 13 different added mineral substances in proportions designed to meet the particular requirements of the young animal, as disclosed by exhaustive investigations.

The vitamin enhancement alone involves the addition of those vitamins in relative proportions which investigation has shown to be superior to the proportions normally contained or even attainable in the natural lacteal secretion, in which, among other factors, they are limited by the quality and mits a predetermined uniformity of composition and nutritional quality not attainable by natural means and sole recourse to the natural milk. The vitamin content of each eight ounces is: not less than 4,000 international units of vitamin A; 225 international units of vitamin B_1; 150 Sherman-Bourquin units of vitamin B_2(G); and 500 U. S. P. units of vitamin D.

Notwithstanding the predetermined characteristics of simulated bitch's milk compounded and fabricated in accordance with scientific principles, it would be presumptuous to imply that the artificially produced product has duplicated or surpassed in nutritive and biological properties the normal product elaborated by nature. Nevertheless, such an artificially prepared product, embodying the principles already enumerated, comes more closely, in terms of practical response of a nursing pup, to natural bitch's milk than it has been possible to attain heretofore by following the rather antiquated methods of merely modifying cow's milk. And, it may be stated without exaggeration, the mineral and vitamin enhancement of the simulated product undoubtedly represents a superiority in those respects above that found or attainable in natural bitch's milk.

Recapitulation

The equipment and supplies for initiating artificial feeding of puppies described in the foregoing comprise:

1. Beam-type scale, reading in grams.
2. Pyrex graduate, marked in cubic centimeters.
3. Glass, porcelain or enamelware measuring spoon or cup, accurately marked for cubic centimeters.
4. Enamelware saucepan, with cover; capacity one or two quarts.
5. Enamel, glass or metal mixing spoon.
6. Glass containers of suitable size with cover for storing formula.
7. Glass, pyrex or enamel funnel.
8. Glass or pyrex infant nursing bottles, four- or six-ounce size.
9. Special puppy nipples for nursing bottles.
10. Box or cabinet for storage of all feeding and mixing utensils.
11. Nipple brush.
12. Bottle brush.
13. Glass container for storage of bottles and nipples.
14. Soap, wash cloths, towels, scouring powder and dishpan.
15. Artificial or simulated bitch's milk.
16. Chart for recording daily weights of puppies.
17. Printed puppy feeding schedule (VET. MED., Feb., 1939, p. 125).

It is difficult to enumerate all the conditions or circumstances under which the artificial feeding of young puppies may be desirable. For the experienced practitioner it is unnecessary to enumerate them, but for those with little or no experience in small animal practice, it may be useful to suggest the following circumstances that make desirable the artificial feeding of puppies for a longer or shorter period:

1. When the bitch dies.
2. In serious cases of dystocia or illness that make it desirable for a day or longer to keep the puppies away from the bitch.
3. When the number of puppies in the litter is greater than can be properly nourished by the bitch.
4. In cases of ringworm, mange, helminthiasis (hookworm, filaria, etc.) in the bitch.
5. Agalactia in the bitch.
6. When the bitch produces abnormal milk.
7. To prevent the development of the mammary glands or nipples for cosmetic reasons.
8. To take the puppies from the bitch at an early age that the bitch may be benched or raced.
9. When it is necessary to medicate the bitch with some drug that may be eliminated in the milk.
10. When the milk, though apparently normal, seems unsuited.
11. In the rare conditions where the milk is lethal. This includes not more than 1% of bitches and probably less. The cause of it is not known. It is probably responsible for the dog owners' superstition concerning "acid milk".

Artificial Feeding Is Practical

In conclusion, it may be repeated that the successful rearing of puppies by artificial feeding is no small task. It requires patience and scrupulous attention to detail. However, there are no insurmountable difficulties. Fortunately, those who raise dogs regard their puppies with sufficient sentiment to make almost any sacrifice for them and, with intelligent guidance, are highly successful in rearing them on artificial bitch's milk. Under sympathetic veterinary direction, a large majority of the puppies requiring it, can be reared by artificial feeding and it pays dividends, good dividends, to both the dog raiser and the veterinarian. Nor should it be forgotten that a normal, playful dog reared on artificial bitch's milk, is an asset to a veterinarian's practice, while a puppy that is permitted to die for lack of artificial feeding is not. Further, the remarkable "smartness" and easier training of puppies artificially fed as compared with those fed naturally, mentioned in the preceding article (VET. MED., April, 1939, p. 260) conduces to satisfaction of owners with their dogs and increases the popularity of these pets with them and their friends.

Canine pediatrics is an eminently satisfactory branch of veterinary practice, not only for the appreciation and the fees it earns, but as a practice builder with few equals among those who own and love dogs.

NOTE:—Reprints of this series of 12 articles will be prepared immediately and supplied as a serviceably bound (in leatherette paper) 80-page booklet. Those desiring copies should send in their orders at once. The price will be nominal.

Abstracts

Veterinary Education Under Modern Requirements

A careful selection of students is the best guarantee for the future of our profession; it is essential that present standards be maintained.[48] The program of teaching must comprise everything that concerns the production, care, and utilization of animals. Hygiene and preventive and curative medicine form a complex that cannot be dissociated. Further, teaching programs, theoretical or practical, must incessantly be adapted to the variable importance of the various aims of professional practice; they should introduce the practitioner to rural life and to the principles of breeding, as well as to his professional activities in the fields of medicine and meat inspection. The extension of postgraduate instruction to all practitioners should also be given attention.

* * * *

The Importance of the Veterinarian in Animal Husbandry and Food Inspection

The activity of the veterinarian is often supposed to be limited to the treatment of sick animals.[49] In reality, his rôle is much more extensive and significant, since he is largely responsible for assuring both the abundance and the safety of the nation's food supply. To assure an *abundant* food supply, epizoötics must be eradicated or checked, and breeding problems must be solved to permit adequate production. Only the veterinarian has the training necessary to accomplish this two-fold program. To assure a *safe* food supply, the animals from which the food products for human consumption are obtained must be free from diseases transmissible to man, and subsequent handling and processing must be supervised to prevent contamination. Again, it is the veterinarian who is qualified to perform this task; in the interest of public health, the production and sale of foods of animal origin should be, and in many nations are, under strict veterinary supervision.

* * * *

The Influence of Nutrition on the Constitution of Pigs

Experiments comprising several thousand pigs each year have shown that a large number of cases of illness in pigs is due to a weakened constitution.[51] This weakening in constitution in most cases can be traced to a lack of vitamins, of certain mineral substances, and of certain amino acids in the foodstuffs.

Experimentally, it has been easy to produce a weak constitution in pigs by feeding with bran, tapioca meal, and other "one-sided" feeds; but weakness has also occurred when rye or wheat was fed. We also found a weakened constitution in pigs which were fed with barley which was harvested in Denmark in the summer of 1935. The symptoms of a weak constitution appeared in pigs of varying ages, but as a rule in those with a weight of 90 to 150 pounds. On observation, the pigs present a very unthrifty appearance. They have a roughened or bristling hair-coat, a greasy, dirty skin which becomes incrusted with scabs, and many suffer from respirational difficulties (dyspnea) and a cough. The pigs often get a violent diarrhea and their daily gains are reduced to a minimum. In some cases, at times over 50%, a large number of pigs die, after previous cramps and lameness in the hind part of the body. It is especially characteristic that feeding with a certain food material will produce a pronounced weakness in the pigs in some cases, while in other cases no weakness is observed; in spite of apparently uniform rations, there are wide variations in results. Thus the results are also affected by the composition

[48] Leclainche, E., 1938. L'Enseignement Vétérinaire et son Adaptation aux Exigences Modernes. Presented to the XIII International Veterinary Congress, Zürich-Interlaken, Switzerland, Aug. 21-27, 1938.

[49] Stang, V., 1938. Die Bedeutung des Tierarztes in der Zucht und Haltung der Tiere sowie in der Erzeugung von Nahrungsmitteln tierischen Ursprungs. Presented to the XIII International Veterinary Congress, Zürich-Interlaken, Switzerland, Aug. 21-27, 1938.

[51] Jesperson, Johs., 1938. Der Einfluss der Ernährung auf die Konstitution der Schweine and die Konstitution im Zusammenhange mit dem Hämoglobinprozent. Presented to the XIII International Veterinary Congress, Zürich-Interlaken, Aug. 21-27, 1938.

of the other feeds used, the barn conditions, and the inherited type of the pigs.

In most cases, even the most severe, we were able to prevent and cure the weakness with a small supplement of a mixture of 80% $CaCO_3$ and 20% NaCl.

By means of 30,000 individual tests we have ascertained the percentage of hemoglobin in the blood of pigs. These tests included newborn pigs, young, growing pigs, and older pigs. In individual cases it is difficult to determine the strength of a pig's constitution on the basis of the percentage of hemoglobin in the blood. This is due to the fact that the percentage of hemoglobin depends upon the individual inherited type, the season, the feeding of the pigs, the hygienic condition of the hog-pen, and upon additional factors. We have found, however, that nearly all the pigs which after slaughter showed symptoms of tuberculosis, previous pneumonia, or some other infection, had a low percentage of hemoglobin at a young age. On the other hand, symptoms of infection were rarely found in slaughtered pigs which at a young age had a high percentage of hemoglobin.

The Resistance Factor in the Control of Infectious Diseases

In investigating the general and local factors of resistance against infection and disease from the standpoint of our knowledge of physiology and physiological chemistry, relations are found between resistance and the general factors of heredity, the internal secretions, the vegetative nervous system, irradiation, nutrition, and, above all, the hypovitaminoses.[50] Among the local conditions, the oxydoreduction potential is of especial importance for the proliferation of obligatory aërobics and anaërobics. Chemotaxis, the pH, the reactions of the blood vessels and their permeability, likewise play a part in the establishment and development of microörganisms. Apparently the control of infectious diseases requires not only the application of the usual methods, but also the creation of favorable conditions in the individual and the breeding of resistant strains, since the importance of the resistance factor is being increasingly realized.

The Regulation of Mineral Metabolism

Harmonious metabolism of minerals is an indispensable factor in the normal, healthy functioning of men and animals.[52] The minerals themselves are the first and most important regulators of mineral metabolism; certain of them may be regarded as controlling substances.

Colloidal hydroxide of magnesium is, when administred parenterally, the controlling substance or regulator of calcium and the OH group. Phosphate of magnesium, administered by mouth, is the controlling substance for calcium and the PO_4 group.

Potassium oxalate is a specific poison for calcium metabolism; if administered parenterally, even in subtoxic doses, the vegetative nervous system ceases its functions little by little; a lack of ionized calcium causes the suprarenal capsules to atrophy; then, the arteries lose their elasticity (arteriosclerosis); atrophy, ulcers, and adenoid growths develop in the mucous membranes of the stomach; bones break easily, as in old age.

The proper application of automatic regulators of mineral metabolism ensure: a normal course of pregnancy; rapid growth of the young; a maximum of work and productivity. There have also been noted prophylactic and therapeutic effects in certain specific deficiency diseases (rachitis, osteomalacia) and beneficial effects in cases of inflammation and infectious diseases.

[50] Frei, W., 1938. Allgemeine Bedingungen der Entstehung von Infektionskrankheiten. Presented to the XIII International Veterinary Congress, Zürich-Interlaken, Switzerland, Aug. 21-27, 1938.

[52] Becka, Jan, 1938. Der Mineralmetabolismus, seine Bedeutung in der Therapie und in Bezug auf Leistungsfähigkeit. Presented at the XIII International Veterinary Congress, Zürich-Interlaken, Switzerland, Aug. 21-27. 1938.

Calcium Metabolism in Cows

The authors[45] studied the effect of intravenous injections of calcium gluconate on cows in which the blood calcium was regarded as normal. They found that injection of 50 to 60gm of calcium gluconate rapidly caused marked respiratory and cardiac distress, profuse salivation and watering of the eyes, and muscular tremors; they interpreted these effects as being due to excitation of the parasympathetic nervous system. After injection, the calcium level of the blood rose, but tended to return rapidly to normal. They concluded that this was due to the rapid immobilization of the excess blood calcium by the cells of the soft tissues, only a small fraction being eliminated by the kidneys and intestinal tract.

* * * *

Bacteriological Inspection of Meat

The author describes the objective and subjective directions which should be observed in the inspection of meat, the macroscopic changes which appear in meat eight, 12, and 20 hours after slaughter, and the relation between the anatomo-pathological aspect and the presence of toxic agents in meat apparently sound otherwise.[53]

The author shows the importance and the value of the bacteriological examination of meat done in Italy with the aid of the medium of Gassner, with the addition of glucose, and gives a résumé of the results in 750 bacteriological examinations done at the municipal abattoir at Milan. The material came from sick animals, from various processing sections of the abattoir. The bacteriological examination demonstrated bacteria in 39.5% of the cases. The bacteria isolated comprised essentially saprophytes (*B. coli communis, B. coli Standfuss,* etc.) which had gone through the intestinal wall. The bacillus of Gartner was isolated on three occasions (always in calves) and the bacillus of Bresslau twice (the first time in a heifer affected with serious interstitial hepatitis and chronic peritonitis without macroscopic changes in the meat). The lymphatic glands are more often infected than the meat; of 264 cases examined, microbes were found in 257 instances (97.5%). It must be mentioned also that of 156 examinations of meat from animals showing serious lesions, bacterial contamination was found in but 58 cases. It may be concluded that in the other cases the microbes were assimilated by the lymphatic glands or destroyed by the muscular tissues. Bacteriological examination, the author concludes, should be used as a complement of macroscopic examination in meat inspection, since it may lead to the discovery of bacteria capable of impairing human health, which are not always apparent on gross examination.

* * * *

The Significance of Physico-Chemical Changes in Meat

Bacterial and parasitical changes of flesh may be caused by microbes and parasites pathogenic for animals only, or for both animals and man.[54] Hence, meat may be classed (1) as dangerous or not dangerous to human health, and (2) as fit, unfit, or conditionally fit for consumption.

The keeping quality of meat depends on the physico-chemical changes in the flesh. By ascertaining the degree of these changes through the determination of the pH, it is possible to detect the beginning of harmful decomposition in the muscular tissue, and to judge the state of the animal when it was slaughtered.

Serological examination of meat extract of animals suffering from cysticercosis or trichinosis by means of the precipitation test yields good results even when the parasitic infestation is so slight as to be undetectable macroscopically.

[45] Rubay and Bertrand, 1938. Contribution a l'étude des effets biologiques et du métabolisme du calcium. *Ann. Méd. Vét.* 83:97-112. Abst. in *The Vet. Bul.* by N. J. Scorgie.

[53] Valenti, E., 1938. I Risultati dell'esame Batteriologico delle Carni nei Riguardi della Presenza dei Germi, e delle Loro Alterazione Fisico Chimiche (Organolettiche). Presented to the XIII International Veterinary Congress, Zürich-Interlaken, Switzerland, Aug. 21-27, 1938.

[54] Trawinski, Alfred, 1938. Ursachen, Erkennungsmethoden und Bedeutung für die Fleischbeurteilung Bakterieller, Parasitärer und Physikalisch-chemischer Fleischveränderungen der Schlachttiere. Presented to the XIII International Veterinary Congress, Zürich-Interlaken, Switzerland, Aug. 21-27, 1938.

Book Reviews

ANIMAL PATHOLOGY. *By Russell A. Runnells*, D.V.M., M.S., Associate Professor of Veterinary Pathology, Iowa State College. Cloth bound. 464 pages; 127 illustrations. Collegiate Press, Inc., Ames, Iowa, 1938. $6.00.

This work is divided into three parts. Part I deals with general pathology, Part II with systemic pathology, and Part III with the special pathology of the specific infectious diseases of animals. The subject matter is well illustrated with selected cuts from animal sources, showing gross and microscopical pathological changes. The text is well-printed on a good quality of paper and the type is large enough to make reading easy. A biblography is given at the end of each chapter, and this feature adds greatly to the usefulness of the book.

It is quite evident that the author has devoted much time to the study of the world's veterinary literature. Therefore, it is regrettable that the various subjects are dealt with so briefly. The discussion of gross pathological changes is perhaps sufficient to meet the requirements of such a text and will serve the practitioner well as a hand book on post-mortem examination, but the discussion of the microscopical pathological changes are in most cases extremely brief. If this brevity is the result of an endeavor to keep the cost of the book within a certain limit, it seems to have been a mistake, as in most instances even a few added paragraphs would have added greatly to its usefulness, and to its interest as well.

There are a few statements that seem somewhat dubious. As an example, on page 289, alcohol is given as a cause of cirrhosis of the liver, and on page 352 as a cause of neuritis. While the excessive use of alcohol may produce these changes in man, animals not being addicted to its excessive use it does not produce these changes in them.

The book, on the whole perhaps the most complete production on the subject by an American author, is, therefore, a welcome contribution to American veterinary literature.—*L. E. D.*

BLOODHOUNDS and How to Train Them. *By Leon F. Whitney*. Paper bound. 34 pages, illustrated. Privately printed. 50c.

This brochure gives a brief account of the history and characteristics of the bloodhound, and a detailed description of methods of training for man-trailing. Based on the experience of the author at his White Isle Kennels, Orange, Conn., it makes interesting reading and contains valuable suggestions for those interested in this breed of dogs. Some of the training methods developed by Mr. Whitney, who, incidentally, is now a veterinary student (junior), are applicable to the training of other breeds for other purposes than man hunting, in fact for general training in obedience.

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THE PEKINGESE. *By Anna Katherine Nicholas*. Cloth bound. 141 pages; 185 illustrations. Judy Publishing Company, Chicago, 1939. $2.00.

Miss Nicholas, as a breeder, exhibitor and show judge of Pekingese, is well qualified to discuss this breed of dogs, and her book represents a rather complete compilation of Pekingese data. A discussion of the origin, history, and development of the breed is followed by a description of its traits and disposition; an analysis of the official Pekingese standard; principles and methods of breeding, feeding, care and training; and suggestions for kennel management and showing dogs, including a digest of dog show rules.

The book should be useful for both breeders and pet owners, since it contains many helpful suggestions within a small compass. The illustrations are on the whole disappointing, most of the reproductions lacking clarity. However, those who, like Miss Nicholas, are intrigued by the tiny dog which, according to an ancient legend, is the result of a romance thousands of years ago between a lion and a squirrel, will find the book entertaining and valuable in spite of its occasional typographical shortcomings.